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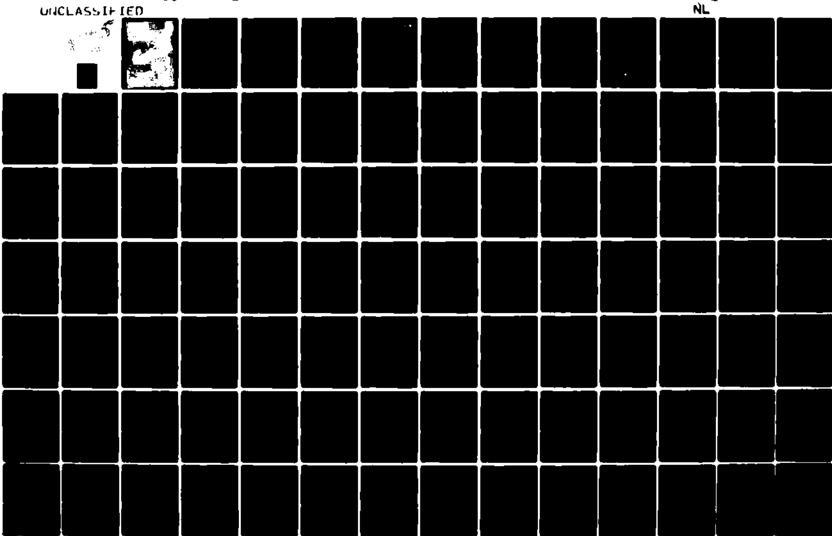

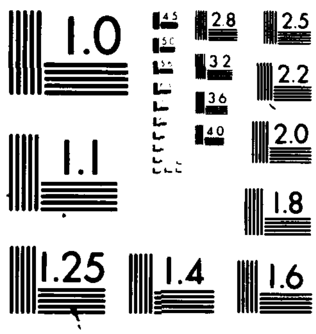

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This bibliography provides a reference that will be of aid to those individuals and/or agencies planning or initiating limnological research on Lake Erie and/or its tributaries. The bibliography is divided into five sections: biological, chemical, engineering, physical, and socio-economic. Pertinent information from both United States and Canada are documented. The papers cited in the annotated bibliography are located at Great Lakes Laboratory of the State University College at Buffalo unless otherwise noted.

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by

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State University College at Buffalo

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I. INTRODUCTION

The purpose of this study, which was sponsored under Contract DACW 49-74-C-0102 from the Buffalo District of the U. S. Army Corps of Engineers, was to provide a reference that would be of aid to those individuals and/or agencies, planning or initiating limnological research on Lake Erie and/or its tributaries. The task was divided on the basis of disciplines into five (5) sections - biological, chemical, engineering, physical and socio-economic.

The holdings of libraries in both the United States and Canada were surveyed. Each pertinent reference was abstracted and examined with respect to the location (s) in which the study was conducted, parameters measured and techniques employed. In addition, the last known address of the agency or senior author was included to assist in locating the author if further communication is desired.

Unless otherwise noted, the papers cited in the annotated bibliography are located at the Great Lakes Laboratory of the State University College at Buffalo.

Due to limitations in time, we were unable to secure copies of all the references that may contain information relative to Lake Erie. These have been included in this paper.

II. SUBJECT INDEX

The number following each, refers to the number of the paper listed in Section III. Lake Erie was divided into twenty-one (21) regions, which are shown in Figure 1. The number twenty-two (22) refers to lake-wide studies; while numbers twenty-three (23) through thirty-four (34) concern specific tributaries to the lake. Thirty-five (35) concerns Sandusky Bay; while thirty-six (36) includes other tributaries.

A. Study Regions

1. 1, 18, 32, 43, 55, 57, 58, 69, 73, 76, 77, 81, 100, 101, 119, 126, 146, 149, 151, 153, 174, 181, 187, 188, 201, 211, 220, 227, 228, 229, 236, 240, 242, 244, 249, 250, 254, 258, 275, 300, 316, 326, 328, 329, 332, 350, 351, 355, 358, 360, 366, 371, 380, 384, 385, 386, 388, 390, 391, 392, 440, 454, 457, 458, 463, 473, 488, 502, 504, 529, 530, 547, 596, 598, 603, 604, 625, 626, 630, 636, 637, 646, 652, 665, 679, 680, 683, 684, 723, 725, 733, 746, 747, 748, 749, 750, 751, 793, 795, 804, 811, 818, 827, 834, 836, 837, 839, 856, 861, 871, 875, 879

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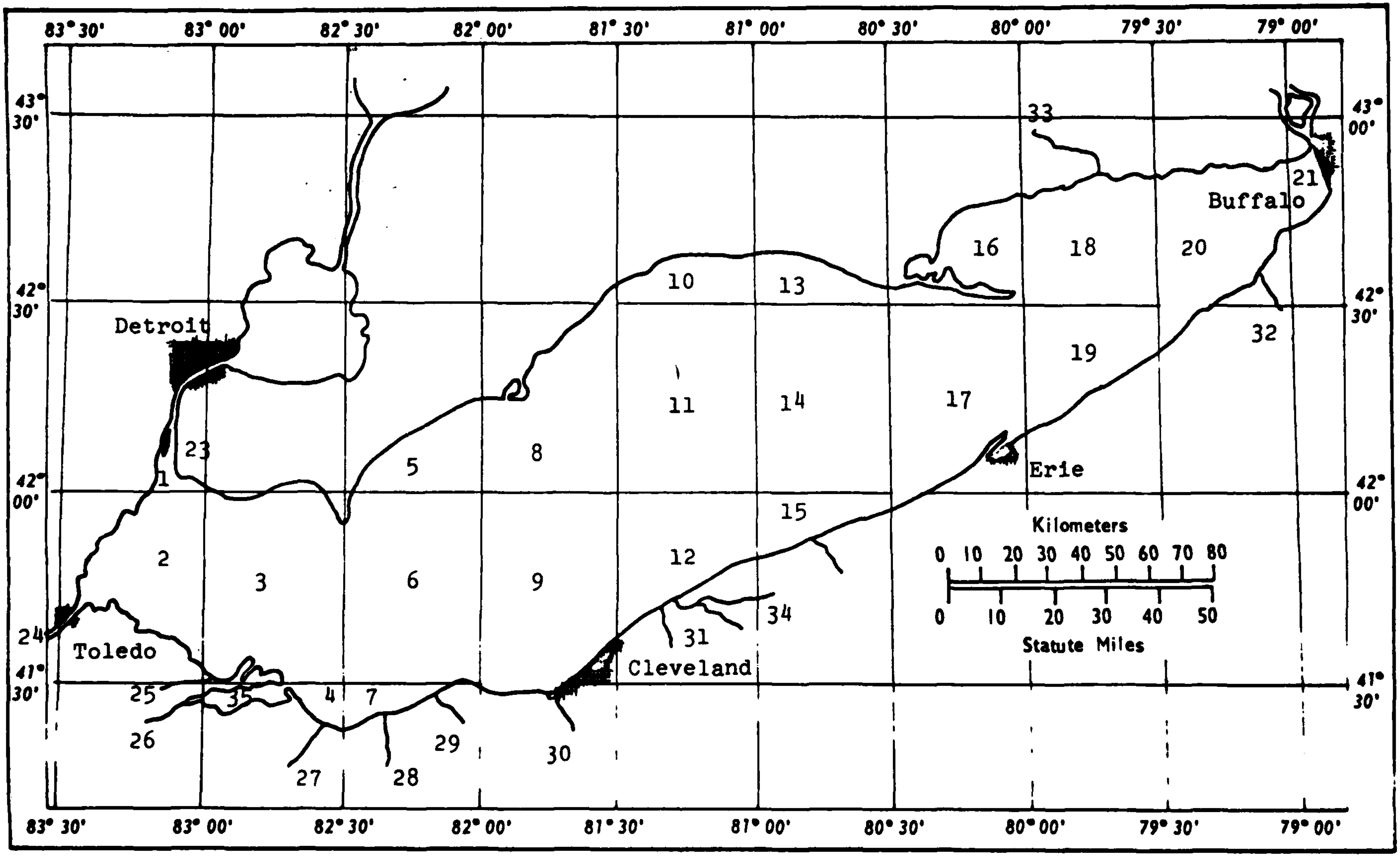
3. 1, 3, 4, 5, 7, 8, 10, 11, 13, 18, 19, 21, 32, 36, 37,

Figure 1 - MAP OF LAKE ERIE



22 = Lakewide 36 = Other Tributaries

KEY TO FIGURE 1

#	Numerical	#	Alphabetical
1 - 21	Quadrants in Lake Erie	29	Black River
22	Lakewide	32	Cattaraugus River
23	Detroit River	31	Chagrin River
24	Maumee River	30	Cuyahoga River
25	Portage River	23	Detroit River
26	Sandusky River	34	Grand River (Ohio)
27	Huron River	33	Grand River (Ontario)
28	Vermilion River	27	Huron River
29	Black River	22	Lakewide
30	Cuyahoga River	24	Maumee River
31	Chagrin River	25	Portage River
32	Cattaraugus River	35	Sandusky Bay
33	Grand River (Ontario)	26	Sandusky River
34	Grand River (Ohio)	28	Vermilion River
35	Sandusky Bay		
36	Other Tributaries		

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31. Chagrin River - 217, 245, 266, 391, 458, 494, 532, 601, 610, 615, 616, 627, 632, 658, 687, 708, 779, 785, 787, 795, 801, 804, 813

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34. Grand River (Ohio) - 179, 281, 391, 392, 393, 473, 494, 515, 532, 601, 610, 615, 616, 632, 658, 687, 779, 785, 791, 800, 804, 813, 876

35. Sandusky Bay - 1, 4, 41, 43, 51, 72, 84, 115, 162, 175, 177, 185, 186, 187, 189, 205, 210, 229, 237, 266, 280, 290, 300, 314, 333, 341, 349, 361, 395, 397, 398, 399, 402, 410, 411, 412, 413, 418, 420, 421, 439, 448, 449, 457, 458, 463, 490, 493, 506, 515, 517, 532, 539, 540, 542, 544, 545, 547, 596, 598, 599, 601, 610, 613, 615, 616, 617, 623, 624, 625, 626, 638, 646, 652, 657, 660, 661, 684, 688, 689, 694, 699, 707, 708, 724, 725, 726, 738, 742, 745, 747, 748, 769, 779, 780, 785, 791, 800, 801, 804, 811, 813, 816, 820, 823, 825, 826, 835, 847, 854, 857, 867, 870, 871, 874

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B. <u>**Organisms**</u>

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2. **Schizomycota** - 13, 17, 23, 26, 27, 31, 47, 48, 54, 56, 57, 58, 61, 65, 71, 74, 75, 82, 83, 86, 93, 97, 101, 104, 109, 111, 112, 114, 130, 131, 132, 133, 135, 136, 137, 138, 139, 140, 141, 142, 157, 171, 174, 178, 179, 183, 184, 186, 197, 224, 232, 233, 240, 245, 247, 260, 261, 26[illegible], 270, 272, 291, 292, 293, 311, 312, 314, 334, 338, 339, 348, 357, 367, 368, 377, 384, 385, 390, 391, 392, 393, 394, 401, 416, 427, 431, 437, 451, 454, 458, 461, 464, 473, 475, 476, 477, 491, 492, 494, 495, 502, 509, 510, 515, 519, 520, 521, 522, 530, 532, 537, 593, 594, 598, 605, 606, 629, 632, 634, 636, 641, 642, 647, 650, 657, 658, 662, 667, 668, 677, 685, 691, 703, 704, 705, 711, 738, 739, 755, 773, 786, 787, 789, 791, 792, 793, 794, 795, 796, 799, 800, 801, 803, 804, 805, 814, 823, 836, 837, 855, 866, 876, 880, 882, 883

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d. Charophyta - 50, 66, 115, 226, 384, 398, 399, 428, 440, 518, 738, 758, 761, 795, 810, 881

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e. Hoop - 162, 166, 271, 355

III. ABSTRACTS

1. Abrams, James P. and Clarence E. Taft. 1971. A bibliog- of research conducted at the Franz Theodore Stone Laboratory, and its predecessor, of the Ohio State University from 1895 to 1968. Ohio J. Sci. 71(2):81-105.

A comprehensive bibliography has been compiled of 580 citations that represent more than 70 years of research in the biological sciences and related fields at The Ohio State University's Biological Sciences Laboratory on Western Lake Erie. Of these, 435 citations are from more than 70 domestic and foreign journals. The remainder refer to theses, dissertations, and unpublished manuscripts prepared under the auspices of the Laboratory and included for their research data, and available in the Botany and Zoology library at The Ohio State University.

2. Adamstone, F. B. 1922. Rates of growth of the blue and yellow pike perch. Ont. Fish. Res. Lab. Pub. 5:77-86.

The rates of growth of blue and yellow pike perch were determined from specimens obtained during the summer of 1920 at Merline, Ontario on Lake Erie. Included is a brief description of the procedures followed to determine age by analysis of scale samples. (CCIW)

Addis, James T. - See: N. Wilson Britt, No. 93.

Ahlstrom, Elbert H. - See: Lewis H. Tiffany, No. 771.

3. Ahlstrom, Elbert H. 1930. Mullusks collected in Bass Island region, Lake Erie. Nautilus. 44(2):44-48.

A list of species collected during the summers of 1928 and 1929. The site of collection is noted in each case. (SM)

4. Ahlstrom, Elbert H. 1934. A quantitative study of rotatoria in Terwilliger's Pond, Put-in-Bay, Ohio. Ohio Biol. Surv. Bull. 30. 6(1):1-36.

A report on a statistical study of a series of quantitative plankton collections of rotifers made in Terwilliger's Pond, Put-in-Bay, Ohio. These collections were made during the summer and fall of 1932 and the spring of 1933. A comparison is made between the rotifer fauna of this region and that of other American habitats. An attempt is made to illustrate

the seasonal periodicity by genera of the rotifers. (SM)

5. Ahlstrom, Elbert H. and Lewis H. Tiffany. 1934. The algal genus *Tetrastrum*. Am. J. Bot. 21(8):499-507.

This paper presents a critical evaluation of the species of the genus *Tetrastrum*. The variations in form, in numbers of spines, and in size of the coenobia in the species are considered in detail. Some previously described species are referred to separate genera, while others are shown to be synonymous. (BU)

Akers, J. F. - See: R. A. O'Reilly Jr., et al, No. 607.

Alden, Jon C. - See: Daniel G. Bardarik, et al, No. 46.

6. Aldrich, John W. 1943. Biological survey of the bogs and swamps in northeastern Ohio. Am. Mid. Nat. 30(2):346-402.

This study is intended to picture the composition and dynamics of the various biotic communities which make up the swamps and bogs (hydrosere) of northern Ohio. The report shows their successional relationship to each other, and indicates their dependence on climatic and physiographic factors. Ecological classifications of northwestern Ohio hydrach species are included. (SM)

7. Allbaugh, Clyde A. 1963. Reducing the oxygen content of lake water used at the Put-in-Bay Hatchery. Prog. Fish Cult. 25:108-109.

A problem of oxygen supersaturation in the water used at the Put-in-Bay Hatchery on South Bass Island, Ottawa County, Ohio caused noticeable losses of walleye pike (*Stizostedion v. vitreum*). The supersaturated water is a result of temporary conditions in Lake Erie. To reduce these egg losses, a method of reducing the oxygen content of water entering the hatchery was devised in which lake water with a temperature range of 44-61° F. was mixed with domestic well water of a constant temperature, 52°. This mixing produced water with an oxygen content of 52-57% saturation. Oxygen saturation values in this range had no apparent detrimental effects on the walleye eggs and resulting fry, and also reduced flotation-caused loss of eggs. (SL)

8. Allbaugh, Clyde A. and Jerry V. Manz. 1964. Preliminary study of the effects of temperature fluctuations on

developing walleye eggs and fry. Prog. Fish Cult. 26:175-180.

Analysis of April water temperature records at the Put-in-Bay Hatchery on South Bass Island from 1918 to present indicates that developing walleye (*Stizostedion v. vitreum*) eggs have been subjected to rapid fluctuations as high as 8° F. over a 24-hour period. An experiment designed to test effects of water temperature fluctuations above a base temperature on the development and/or survival of walleye fry and eggs during the 1961 season was undertaken. Groups of eggs were separated to determine the effects of temperature fluctuation on cleavage, differentiation, organogenesis and hatching. A temperature fluctuation involved a slow increase in temperature of 8° F. in four hours, held constant at this temperature for four hours and slowly decreased to the base temperature in four hours. The percent hatch at the Put-in-Bay Hatchery for 1961 was 28 percent. In the experimental groups, the percent of eggs hatched was: control, 27.9%; cleavage fluctuation, 30.3%; differentiation fluctuation, 27.2%; and organogenesis fluctuation, 39.2%. (SL)

9. Allen, Herbert E. 1970. Chemical and biological quality of Lake Erie. In: The Environmental Problems of the Lake Erie Basin. Carroll Business Bull. 10(1):17-22.

A discussion of the need for control of the disposal of organic materials in Lake Erie. The relationship of phosphorus to algal blooms and concentration of pesticides in fish, particularly those with higher levels of body fat, are discussed.

10. Allen, John A. 1915. Shells of Put-in-Bay Island, Lake Erie. Nautilus. 29(2):18-20.

A brief report listing shells found on Put-in-Bay Island and Kelleys Island. They include forms of *Polygyra*, *Vallonia*, *Bifidaria*, *Vitrea*, *Zonitoides*, *Agriolimax*, *Succinea*, *Philomyeus*, *Pyramidula*, *Helicodiscus*, *Carychium*, and *Lymnaea*. (SM)

11. Alley, Wayne P. and Charles F. Powers. 1970. Dry weight of the macrobenthos as an indicator of eutrophication of the Great Lakes. Internat. Assoc. Great Lakes Res. Proc. 13th Conf. on Great Lakes Res. pp. 595-600.

The dry weight of the macrobenthos was used to conduct intercomparisons of benthic productivity among Lakes Superior, Michigan, Huron, and Erie. The grand average dry weight of

macrobenthos was found to be 0.9 gm/m^2 for Lake Superior, 3.40 gm/m^2 for Lake Michigan, 1.48 gm/m^2 for Lake Huron, and 4.63 gm/m^2 for Lake Erie. These values were compared with similar values from Canadian lakes whose trophic levels were defined by Rawson (1953). These comparisons support the classification of Lake Erie as a well-developed eutrophic lake.

12. Allin, A. E. 1929. Seining records and food of the intermediate stages of Lake Erie fishes. In: Preliminary Report on the Cooperative Survey of Lake Erie, Season of 1928. Buffalo Soc. Nat. Sci. Bull. 14(3):188-194. Also in: A Biological Survey of the Erie-Niagara System. N. Y. Cons. Dept. Suppl. 18th Ann. Rept., 1928. pp. 95-99.

A discussion of the efficiency of the nets used for sampling as well as an account of the food taken by the fish of Eastern Lake Erie.

Allison, Leonard N. - See: David R. Wolfert, et al, No. 873.

Ambrosini, R. - See: L. R. Hedrick, et al, No. 344.

13. Anderson, Bertil G. 1944. The toxicity thresholds of various substances found in industrial wastes as determined by the use of Daphnia magna. Sewage Works J. 16(6):1156-1165.

The threshold concentrations for immobilization of Daphnia magna by forty-two substances when added to Lake Erie water are given. The advantages, as well as a method, of using daphnids as test organisms are also discussed.

14. Anderson, Bertil G. 1945. The toxicity of DDT to Daphnia. Science. 102(2656):539.

A series of experiments were carried out to determine the threshold concentration of toxicity to Daphnia magna.

15. Anderson, Bertil G. 1946. The toxicity of various sodium salts determined by the use of Daphnia magna. Sewage Works J. 18(1):82-87.

The aim of this paper is to present the threshold concentrations of toxicity for thirty-eight sodium salts, ions of which occur in industrial wastes. The test animal used was Daphnia magna and all experiments were carried out using centrifuged Lake Erie water.

16. Anderson, Bertil G. 1948. The apparent thresholds of toxicity to Daphnia magna for chlorides of various metals when added to Lake Erie water. Trans. Am. Fish. Soc. 78:97-113.

The apparent threshold concentrations of toxicity to Daphnia magna are presented for 25 cations when added to Lake Erie water. Various factors such as the specific toxic actions of the cations, high acidities, excessive osmotic pressures, and precipitates operated to kill daphnids when the salts used were above the thresholds. When factors other than the specific toxic actions may have been responsible for death at threshold concentrations they are described. The thresholds presented are compared with those found by other investigators for Daphnia and other animals, especially fish. In general the Daphnia and related forms are more susceptible to cations than are fish.

Ecdysis is a critical period in the life of Daphnia, particularly in the presence of certain salts. Various explanations are advanced to account for this fact. Since daphnids are more susceptible at molting it is essential that exposure periods be long enough to provide sufficient time for all the experimental animals to molt when threshold concentrations of toxicity are determined. This finding is expected to apply in toxicity experiments with other arthropods.

That the maximum safe concentrations in which wastes may be permitted to enter natural waters are not likely to exceed the threshold concentrations to Daphnia is discussed.

17. Anderson, D. V. 1969. To justify Great Lakes research. In: Proc. Conf. for the Users of the Great Lakes, November 3-4, 1969. Univ. Toronto. Great Lakes Inst. Toronto, Ont. pp. 48-62.

This paper discusses the need for an overall point of view in the planning of research on the Great Lakes. Changes in the Lake Erie fishery and differing regulations in Canadian and U. S. waters are mentioned.

Anderson, T. W. - See: C. F. M. Lewis, et al, No. 485.

18. Andrews, Ted F. 1948. Temporary changes in certain limnological conditions in Western Lake Erie produced by a windstorm. Ecology. 29(4):501-505.

Observations before and after a windstorm on April 23, 1947,

led the author to conclude that movements of water reversed the usual tendency in the horizontal variations in: (1) seston, turbidity, and temperature; and (2) abundance in Cyclops and Diaptomus. Further, it is reasonable to believe that winds of lesser magnitudes probably produce similar, but less striking, variations in the horizontal distribution of zooplankton, phytoplankton, and suspended inorganic matter in natural waters. (SM)

19. Andrews, Ted F. 1953. Seasonal variations in relative abundance of Cyclops vernalis Fischer, Cyclops bicuspidatus Claus, and Mesocyclops leuckarti (Claus) in Western Lake Erie, from July 1946 to May 1948. Ohio J. Sci. 52(2):91-100.

Quantitative determinations of seasonal variations in temperature, abundance of seston, and abundance of two species of Cyclops and one species of Mesocyclops were made from monthly collections taken at one meter intervals extending from the surface to the bottom. It was found that organic seston is a good index to standing plankton crop, except when bottom materials have been resuspended. (BU)

Andrle, Robert F. - See: Harold D. Mitchell, No. 534.

20. Annett, C. S., M. P. Fadow, F. M. D'Itri and M. E. Stephenson. 1972. Mercury pollution and Lake Erie fishes. Mich. Academician. 4(3):325-337.

Seventy-nine fish samples of six different genera were collected in Lake Erie in the vicinity of the Raisin River during September-November 1970. These samples were analyzed for total mercury concentration in the muscle tissue.

21. Anonymous. 1901. The summer's work at Sandusky. Ohio Nat. 2(1):141-142.

Brief notes on the locations of collecting trips in the vicinity of the lake laboratory are given. (BU)

22. Anonymous. 1938. Poor fish-in the Great Lakes. State Gov't. 11(3):51-52.

A report on a meeting of public officials from the Great Lakes states and Ontario in February, 1938. This meeting was designed to create an international treaty for uniform regulation of Great Lakes fisheries. The depletion of several species of fish is discussed. (BU)

23. Anonymous. 1965. Erie polluted: Ohio hollers uncle.
Eng. News Rec. 174(14):55.

This news article presents Ohio Governor James A. Rhodes' opinion that the pollution problem of Lake Erie is too extensive to be handled by Ohio alone. Examples of low dissolved oxygen concentration, high coliform counts, and massive algae growth are cited.

24. Anonymous. 1965. Filth in the Great Lakes: What can be done about it. U.S. News and World Rept. 59:58-61.

The problem of pollution in Lake Erie is analyzed by Dr. George B. Langford in an interview with the reporter. He discusses the causes, solution, and costs of these solutions.

Anthony, E. H. - See: F. R. Hayes, No. 343.

Applegate, Vernon C. - See: John F. Carr, et al, No. 146.
Henry A. Regier, et al, No. 652.
David R. Wolfert, et al, No. 873.

25. Applegate, Vernon C. and Harry D. Van Meter. 1970. A brief history of commercial fishing in Lake Erie. Fish and Wildlife Service. Bur. Commercial Fish. Fish. Leaflet 630. 28 p.

Salient features of the development of the industry from about 1815 to 1968, changes in fishing gears and methods, changes in the kinds and abundance of fishes caught, and the attendant effects of disappearing species on the stability of the fishery described. The history and present status of the walleye, yellow perch, and eight other fishes, still taken in commercial quantities, are presented in more detail and are considered in the context of their effect on the current moribund state of the U.S. fishery. Past and present contributions of Lake Erie's tributaries and northerly connecting waters to the fishery are outlined briefly. The "outlook" for the fishery under present conditions of selective over-fishing for high-value species, excessive pollution, ineffective and uncoordinated regulation, and antiquated methods of handling, processing, and marketing fish are discussed, and possible solutions to these problems are suggested.

26. Arnold, Dean E. 1969. The ecological decline of Lake Erie. N. Y. Fish and Game J. 16(1):27-45.

Changes in Lake Erie due to natural processes and the activities of man are discussed with respect to geology, hydrology, pollution, chemistry, plankton, benthos and fisheries. In all of these areas, it is shown that many changes have taken place and that the rate of change has accelerated in recent years. Most of these changes are harmful to the lake's value as a resource for man and as a habitat for its natural fauna. Several proposed ideas for reversing this trend are reviewed.

27. Arnold, Dean E. 1970. Lake Erie alive but changing. N. Y. State Dept. Env. Cons. Albany, N. Y. Conservationist. 25(3):23-30, 36.

This article reviews the changes that are taking place in Lake Erie. The geologic and physical changes, pollution problems, and chemical changes in the lake are all mentioned. Observations on the changing populations of phytoplankton and other algae, the zooplankton, benthic invertebrates and the fisheries are included. The statement is made that by any common measurement there is more life going on in Lake Erie now than there has ever been in the past. However, organisms which we have considered desirable have been replaced by others more adapted to the present conditions.

28. Aron, William I. and Stanford H. Smith. 1971. Ship canals and aquatic ecosystems. Science. 174(40004):13-20.

The ecological effects of the Erie and Welland Canals are discussed. Drastic changes in fish populations of the Great Lakes have resulted.

29. Aulerich, R. J. Jr., R. K. Ringer, H. L. Seagran and W. G. Youatt Jr. 1971. Effects of feeding coho salmon and other Great Lakes fish on mink reproduction. Can. J. Zool. 49(5):611-615.

In 1968 a study was conducted to ascertain if reproductive problems of the mink were due to the Great Lakes coho salmon which was 30% of their diet. Other species of fish from the same lakes were also fed to the mink for comparison. The coho salmon were fed to the mink before and during reproduction. This diet caused a reproductive failure and a kit mortality as high as 80% depending on the amount of coho salmon fed as well as duration of feeding. Canned by-products of

Great Lakes coho salmon were fed to adult mink at the same level as the raw salmon and this resulted in mortality of the mink. Mortality and reduced reproduction also occurred when the mink were fed other types of fish (bloater chub, yellow perch) from the same source. Lake Erie yellow perch and West Coast coho salmon in the diet did not cause excessive mortality or impair reproduction. There was a relationship between the amount of pesticide residue (DDT, dieldrin) found in the fish and the reproduction decline and kit mortality. So this indicates that it is not coho salmon per se which causes these disorders but appears to be dependent upon the species of fish and its environment. (BU)

Bails, Jack D. - See: Ronald J. Evans, et al, No. 249.

30. Baird, R. L. 1901. The birds of Cedar Point, Sandusky. Ohio Nat. 2(1):143-145.

A list of the birds observed on Cedar Point within two miles of its extremity, from July 30 to August 20, 1901, is presented. (BU)

31. Baker, David B. and Jack W. Kramer. 1973. Phosphorus sources and transport in an agricultural river basin of Lake Erie. Internat. Assoc. Great Lakes Res. Proc. 16th Conf. on Great Lakes Res. pp. 858-871.

At the present time, many of the cities within the study area are being required to install phosphorus removal equipment. It is probable that the benefits for Lake Erie from phosphorus removal by "inland" towns will be much less than the benefits of phosphorus removal from towns of comparable size located along the Lake Erie shores. Some of the phosphorus originating from inland towns may never reach Lake Erie. Most of such phosphorus that does reach Lake Erie will arrive during the times of the year when high sediment and diffuse source phosphorus loading is simultaneously occurring. The component of the total output from the river that originates from point sources may arrive in forms in which, and at times when, its biological impact will be much less than point source loading by cities located near the lake. It is uncertain to what extent the "biological activity" of the phosphorus originating from point sources, that "first" accumulates on the stream bed and "then" washes out of the system, differs from the "biological activity" of phosphorus adsorbed onto inorganic sediments. The answer to this question may be important in evaluating the biological impact within Lake Erie of phosphorus

removal at "inland" domestic sewage treatment plants.

Also the biological significance of sediment bound phosphorus originating from diffuse sources depends largely on its release from the sediments after they are deposited in the lake bed.

32. Baker, Frank Collins. 1933. Studies on the bottom fauna of fresh-water lakes. Science. 78(2018): 190-191.

A comparison of information about Lake Erie fauna, presented by F. H. Krecker and L. Y. Lancaster (1933), with data from Lake Winnebago and Lake Oneida. (SM)

33. Baldwin, Norman S. 1962-63. Closing in on a silent killer. N. Y. State Dept. Env. Cons. Albany, N. Y. Conservationist. 17(2):30-32.

An article outlining the life history of the sea lamprey and methods which are being used to control it in the Great Lakes. The first record of the sea lamprey in Lake Erie, November 8, 1921, is mentioned. It is thought that they entered Lake Erie after the deepening of the Welland Canal in 1913-1918. They had little effect on fishing in Lake Erie, but devastated the fisheries of the upper lakes. (SM)

34. Baldwin, Norman S. 1964. Sea lamprey in the Great Lakes. Can. Audubon. Toronto, Ont. 26(5):142-147.

An article tracing the history of the sea lamprey, Petromyzon marinus, in the Great Lakes. Emphasis is on methods which have been tried to control the lamprey population and its effect on fish production. Mention is made of the first recorded catch of a sea lamprey in the fall of 1921 near Port Crewe, Ontario. (SM)

35. Baldwin, Norman S. and Robert W. Saalfeld. 1962. Commercial fish production in the Great Lakes 1867-1960. Great Lakes Fish. Comm. Ann Arbor, Mich. Tech. Rept. 3. 166 p.

A report on the commercial catch of fish from each of the Great Lakes according to year, species of fish, state, and country.

Ball, Robert C. - See: J. James Roosen, No. 679.

36. Banfield, A. W. F. 1962. Notes on the mammals of Pelee Island. National Mus. of Can. Dept. Northern Affairs and National Resources. Ottawa, Ont. Bull. 183. pp. 118-122.

Samples were collected during September, 1958 and July, 1960. Some specimens were trapped and others obtained with a shotgun. An annotated list of the specimens taken is included. It is thought that the island was submerged until recent times and only the white-footed mouse, Peroymscus leacopus, naturally colonized the island. Others walked over the ice, swam flew, or were introduced by man. (SM)

Bangham, Ralph V. - See: George W. Hunter III, No. 387, 388.

37. Bangham, Ralph V. 1925. A study of the cestode parasites of the black bass in Ohio, with special reference to their life history and distribution. Ohio J. Sci. 25(6):255-270.

The study includes examinations of a large number of large and small-mouth bass from many sections of Ohio and from the island region of Lake Erie. In the small-mouth bass seven species of cestodes were found. Two of these were new species and six had not been previously reported for the bass. In the large-mouth bass two species of cestodes were found. It was determined that certain cestodes are obtained by young bass through an intermediate host, copepods, the chief food of the young bass. These cestodes are discussed as to their morphological characteristics, life histories, and distributions. (BU)

38. Bangham, Ralph V. 1926. Parasites other than cestodes in black bass of Ohio. Ohio J. Sci. 26(3):117-127.

A discussion of the parasites, other than cestodes, in the black bass of Ohio. Specimens were taken from Put-in-Bay, West and East Harbors, and the streams of Ohio. The parasites studied are trematodes, nematodes, Acanthocephala, and parasitic copepods. (BU)

39. Bangham, Ralph V. 1927. Life history of bass cestode Proteocephalus ambloplitus. Trans. Am. Fish. Soc. 57:206-209.

A report on the life history of Proteocephalus ambloplitus with special emphasis on identification of their intermediate hosts which serve as food for the bass. (CCIW)

40. Bangham, Ralph V. 1929. Parasites of bait minnows. Trans. Am. Fish. Soc. 59:198-201.

A survey of the parasites of bait minnows collected from Lake Erie and its tributaries in 1928. (CCIW)

41. Bangham, Ralph V. 1933. Parasites of the spotted bass, Micropterus pseudaplites Hubbs, and summary of parasites of smallmouth and largemouth black bass from Ohio streams. Trans. Am. Fish. Soc. 63:220-228.

A study of the parasites of the spotted, smallmouth and largemouth bass from the fresh waters of Ohio. Infection of these species was quite high--90.5%, 89.5% and 86.4% respectively. (CCIW)

42. Bangham, Ralph V. and George W. Hunter III. 1936. Studies on fish parasites of Lake Erie III. Microcotyle spinicirrus MacCallum (1918) Char. Emend. and M. eriensis Sp. Nov. Trans. Am. Micro. Soc. 55(3):334-339.

Descriptions of two species of trematodes Microcotyle spinicirrus and M. eriensis found in sheepshead of Lake Erie. The latter of the two was a new species. (BU)

43. Bangham, Ralph V. and George W. Hunter III. 1939. Studies on fish parasites of Lake Erie. Distribution studies. Zoologica. 24(4):385-448.

The fourth in a series of papers on fish parasites of Lake Erie. The fishes were collected from the eastern end of the lake during the summer of 1928. Collections were made from the western end of the lake in 1927, 1928 and 1929. In working with these collections emphasis was placed upon the helminthes, although each fish was examined for evidence of infection by ectoparasites such as leeches, flukes and copepods. The objectives of the study were: (1) to identify the parasites collected; (2) to describe any new species encountered; (3) to study the regional distribution of these parasites; and (4) to compare the infection by families of fishes and by degree of infestation. (SM)

44. Barans, Charles A. and Richard A. Tubb. 1973. Temperature selected seasonally by four fishes from Western Lake Erie. J. Fish. Res. Bd. Can. 30(11):1697-1703.

This paper presents some insight into the distribution of fish

in areas of thermal discharges by describing the temperatures selected seasonally by four species of fish from Western Lake Erie. Temperature selection of fish naturally acclimatized to ambient environmental conditions each season are reasonable estimates of the reactions of a species to areas of elevated water temperature. (SM)

45. Barbalas, Louis (Ed.). 1973. Great Lakes research project forecasts directory. U. S. Dept. Commerce. Lakes Surv. Center. Detroit, Mich. NOAA Tech. Memo. NOS LSC D 5. 280 p.

A directory of planned research projects in the Great Lakes region.

46. Bardarik, Daniel G., Jon C. Alden, Robert L. Shema, and Albert R. Kupiec. 1971. A study of the effects of heated discharges on the ecology of Presque Isle Bay, Erie, Pennsylvania - interim report, May-September, 1971. Env. Sci. Inc. Pittsburg, Penn. 232 p.

This study was prepared for the Pennsylvania Electric Company. Its purpose is to determine whether or not the discharge of heated water from Penelec's Front Street Station into Presque Isle Bay is altering the ecology, is injurious to aquatic life, is affecting other uses of the waters, or is having any beneficial effects.

A comparison of benthic collections from control stations (in Lake Erie) with those from Presque Isle Bay shows a marked reduction in the number of taxa of larvae of the family Chironomidae.

47. Barry, David E. 1974. Commentary on the Erie County 1973 stream survey report. Erie County Health Dept. Buffalo, N. Y. 24 p.

This publication presents interpretative comments by the Deputy Commissioner of Environmental Health Services concerning the 1973 Erie County Stream Survey Report published by the Erie County Laboratory. Individual streams are mentioned and comments made upon possib'e reasons for the kind of data found by the investigators.

48. Barry, David E. and Ronald D. Koczaja. 1973. Stream survey evaluation report. Erie County Health Dept. Buffalo, N. Y. 93 p.

This report describes an inventory of surface waters of Erie County, New York, taken during June, July and August of 1970. Samples were taken at 161 points along 27 streams. Reports are included on the following streams tributary to Lake Erie: Cattaraugus Creek; Spring Creek; Clear Creek; Big Sister Creek; Muddy Creek; Eighteen Mile Creek; and Smokes Creek.

49. Barry, James P. 1972. The Fate of the Lakes - A Portrait of the Great Lakes. Baker Book House. Grand Rapids, Mich. 192 p.

This book describes present conditions in the Great Lakes and details the many ways in which they are used. Historical data is interwoven with current information on industrial use, shipping, commercial and sport fishing, and recreation. There are numberous photographs of activities on the lakes, including several of the fishing industry on Lake Erie. There is some discussion of various types of water pollution with Lake Erie problems described in some detail. (SM)

50. Battle, Helen I. 1940. The embryology and larval development of the goldfish (Carassius auratus L.) from Lake Erie. Ohio J. Sci. 40(2):82-93.

A report on a preliminary study of the salient features of the embryology of the goldfish (Carassius auratus). Specimens were collected during the summer of 1928 at South Bass Island and Port Stanley. (BU)

51. Bean, Tarleton H. 1903. Catalogue of the fishes of New York. N. Y. State Mus. Albany, N. Y. Bull. 60. Zool. 9. 784 p.

A catalogue of 375 fishes found in New York State. 217 of the species are marine, 141 fresh water, and 17 anadromus; 15 are introduced species. Among the species identified as being found in Lake Erie are: lake sturgeon, Acipenser rubicundus Le Sueur, a frequent host of the lamprey eel, Petromyzon concolor Kirt.; lake catfish, yellow catfish, longjawed catfish; lake minnow, Hybopsis storerianus Kirtland; mooneye or toothed herring, Hiodon tergisus Le Sueur; gizzard shad, Dorosoma cepedianum Le Sueur; burbot, Lota maculosa Le Sueur; calico bass, or Lake Erie bass, Pomoxis sparoides Lacepede. (SM)

52. Beardslee, Clark S. 1944. Bonapart's gull on the Niagara River and Eastern Lake Erie. Wilson Bull. 56(1):9-14.

A paper concerning group movements, dates of molting, and varient plumages of Bonapart's gull as observed on the Niagara River and Eastern Lake Erie. A month by month discussion of expected movements and changes in the species is included. Most observations were recorded along the Niagara River, although there is mention of the Lake Erie shore from Erie, Pennsylvania, to Buffalo. Observations were made between 1921 and 1943. (SM)

53. Beardslee, Clark S. and Harold D. Mitchell, 1965. Birds of the Niagara Frontier region. Buffalo Soc. Nat. Sci. Bull. Buffalo, N. Y. 22: 478 p.

A comprehensive description of the region with an annotated listing of bird species seen. Numerous photographs are included. Specific locations and species which have been seen there are mentioned. General regions of special ornithological interest are identified. Dates of average earliest and latest record and the seasonal status and monthly status of birds in relation to climate are among the topics considered. (SM)

54. Beaver, William C. 1942. Bacterial activities in the subaquatic soils of Lake Erie. Ohio J. Sci. 42(3):91-98.

During the summers of 1939 and 1940, a bacteriological study was made of the bottom soils at various points in Lake Erie around the vicinity of Put-in-Bay. Particularly significant parts of the investigations dealt with the nitrogen transformations and the destruction of plant (algae and hornwort) and animal (mayflies) materials, which have a direct bearing upon the quantity and quality of available food, and hence upon the fisheries industry. (BU)

Beeton, Alfred M. - See: John E. Gannon, No. 277, 278, 279.
J. S. Marshall, et al, No. 506.

55. Beeton, Alfred M. 1960. Great Lakes limnological investigations. Univ. Mich. Great Lakes Res. Div. Proc. 3rd Conf. on Great Lakes Res. Pub. 4:123-128.

Federal limnological research in the Great Lakes in the 1950's is reviewed, and broad comments are offered on the characteristics of the lakes and on evidence for change in certain areas, as Western Lake Erie. Particular stress is laid on the importance of long-term and continuing studies and on the value of interagency and interdisciplinary cooperation for

attacks on problems beyond the capacities of a single group. (LO)

56. Beeton, Alfred M. 1961. Environmental changes in Lake Erie. Trans. Am. Fish. Soc. 90(2):153-159.

Comparison of data compiled during the past 60 years with those from recent studies shows that major changes have occurred in the bottom and fish faunas of Lake Erie. The bottom fauna was formerly dominated by the nymphs of Hexagenia, but at present midge larvae and oligochaetes are most abundant. Blue pike (Stizostedion vitreum glaucum) and cisco (Coregonus artedii), which formerly dominated the commercial catch, are scarce, while other species are more plentiful than formerly.

57. Beeton, Alfred M. 1963. Limnological survey of Lake Erie, 1959 and 1960. Great Lakes Fish. Comm. Ann Arbor, Mich. Tech. Rept. 6. 32 p.

Federal, provincial, state and university organizations participated in cooperative limnological surveys of Lake Erie in September 1959 and August 1960 to determine the extent and severity of the low dissolved oxygen content of the hypolimnetic waters. Observations were restricted to the Central Basin in 1959, but were lakewide in 1960. Approximately 70 percent of the bottom waters of the Central Basin had a serious deficiency during both years. Data was also obtained on the distribution of temperature, transparency, specific conductance, pH and phenolphthalein and total alkalinity. The distributions of the chemical values are discussed in terms of their relationships to each other, and to thermal stratification, river outflow, lake morphometry, and lake currents.

58. Beeton, Alfred M. 1966. Indices of Great Lakes eutrophication. Univ. Mich. Great Lakes Res. Div. Proc. 9th Conf. on Great Lakes Res. Pub. 15:1-8.

The concept of eutrophication is discussed in terms of its relationship to aging of lakes, environmental changes, and pollution. Various changes in physical, chemical, and biological characteristics of the Great Lakes are reviewed. Increases in nitrogen and phosphorus, changes in species composition and increases in the abundance of plankton, decreases in the dissolved-oxygen content of bottom waters, changes in fish populations in Lake Erie, the replacement of Bosmina coregoni by B. longirostris, and extensive growths

of Cladophora are acceptable indices of eutrophication and have been observed in other lakes. Increases in total dissolved solids and major ions may represent environmental changes not necessarily those of eutrophication. Changes in the benthic communities, amount of bacteria, and growth rate of fish may be due to environmental conditions not related to eutrophication, although they may be useful indices of eutrophication if evaluated in terms of conditions in the total environment.

59. Beeton, Alfred M. 1969. Changes in the environment and biota of the Great Lakes. In: Eutrophication: Causes, Consequences, Correctives. National Acad. Sci. Washington, D.C. pp. 150-187.

Although concern over changes in the Great Lakes has existed for many years, the idea that the lakes are undergoing accelerated eutrophication is recent. Environmental changes can be considered in three categories: pollution of inshore areas, long-term changes in open waters, and changes in sediments. On the basis of accepted physiological characteristics, Lakes Superior, Michigan and Huron are oligotrophic, Lake Erie is eutrophic and Lake Ontario is in an intermediate condition. Lake Erie has shown major changes in limnological factors and biota; effects of increased pollution and eutrophication of Lake Erie have spread to Lake Ontario. The most important changes apparently are those occurring in sediments owing to the contribution of large quantities of allochthonous materials resulting from urbanization and industrialization. Changes in sediments are important factors in the observed changes in limnological factors and fish populations.

60. Beeton, Alfred M. 1970. Statement on pollution and eutrophication of the Great Lakes. Univ. Wisc.-Milwaukee. Center for Great Lakes Studies. Milwaukee, Wisc. Spec. Rept. 11. 35 p.

This statement was delivered to the U.S. Senate Subcommittee on Air and Water Pollution of the Committee on Public Works in May of 1970. There is discussion of each of the Great Lakes. Changes in the benthos of the Western Basin of Lake Erie, the increase in blue-green algae, and changes in the fish populations of the lake are detailed. Tables concerning the distribution and abundance of mayfly nymphs and oligochaetes in Western Lake Erie and the commercial fish population between 1870 and the late 1960s are included.

61. Beeton, Alfred M. and David C. Chandler. 1963. The St. Lawrence Great Lakes. In: D. G. Frey (Ed.), Limnology in North America. Univ. Wisc. Press. Madison, Wisc. pp. 535-558.

This paper constitutes a general review of the biological, chemical, and physical characteristics of the Great Lakes. Included is a discussion of the characteristic organisms of each lake as well as changes in species composition and quantity. A historical review of Great Lakes research and the agencies involved is also presented.

62. Beeton, Alfred M. and W. T. Edmondson. 1972. The eutrophication problem. J. Fish. Res. Bd. Can. 29:673-682.

The trophic state of a lake is maintained by continued inputs of nutrients. In very large lakes the inshore environments are affected first by increased nutrient loading and, depending upon the morphology and morphometry, gradually the offshore waters are altered. Data on plankton, nitrogen concentrations, and fish, from early studies on Lake Erie, show progressive changes from the shore lakeward and from the Western Basin eastward.

Bell, Frank H. - See: Bernard S. Meyer, et al, No. 524.

Bell, J. B. - See: B. J. Dutka, et al, No. 240.

Beneke, E. S. - See: J. A. Schmitt, No. 692.

63. Beneke, E. S. and J. A. Schmitt. 1961. Aquatic fungi from South Bass and neighboring islands in Western Lake Erie. I. Uniflagellate and biflagellate phycomycetes. Ohio J. Sci. 61(5):283-285.

This paper is the first of a series planned to enumerate the species of aquatic and soil water fungi from the vicinity of South Bass Island. The survey, which was made during June-July 1959, identified 37 species and 1 variety of aquatic phycomycetes.

Benninghoff, William S. - See: Anne L. Stevenson, No. 744.

64. Benson, Richard H. and Harold C. MacDonald. 1962. Preliminary report on ostracodes from Lake Erie and their stratigraphic implications. Univ. Mich. Great Lakes Res. Div. Proc. 5th Conf. on Great Lakes Res. Pub. 9:140-149.

Ten cores, collected by personnel on C.M.S. Porte Dauphine from the Central and Eastern Basins of Lake Erie, were examined for ostracodes at the University of Kansas. The cores varied in length from several inches to 35 ft. The ostracodes present suggest changes in the lake's thermal history from colder to warmer conditions and differential rates of sedimentation. Analyses of valve shapes and muscle scar patterns of predominantly cypridacean Ostracoda indicate the presence of at least ten species. Of these species three are new, and seven have been described from living forms. One cold-water species appears to be nearing extinction.

Bergman, Harold L. - See: Robert E. Reinert, No. 656.

65. Berry, A. E. 1951. Survey of industrial wastes in the Lake Huron-Lake Erie section of the international boundary waters. Part 1. Introduction and the Canadian section. Sewage and Industrial Wastes. 23(4):508-517.

A discussion of the factors which influence the sanitary quality of the waters or may adversely affect recreation and wildlife. Included is a summary of the industrial wastes discharged from the Canadian side of the boundary. (BECPL)

Berst, A. H. - See: B. F. Bidgood, No. 67, 68.

66. Berst, A. H. and H. R. McCrimmon. 1966. Comparative summer limnology of inner Long Point Bay, Lake Erie and its major tributary. J. Fish. Res. Bd. Can. 23(2):275-291.

This paper reports the first limnological studies to be undertaken of inner Long Point Bay and Big Creek. Data was collected between May and September of 1962. Water levels and temperatures were recorded and chemical analysis carried out. Approximately 90 percent of the bottom of the bay was covered with aquatic plants which included, in order of abundance, Chara, Valisneria, Potamogeton, Najas, Nitella and Anacharis. (SM)

Berti, A. A. - See: C. F. M. Lewis, et al, No. 485.

67. Bidgood, B. F. and A. H. Berst. 1967. Phenotypic characteristics of rainbow trout in the Great Lakes. J. Fish. Res. Bd. Can. 24(4):887-892.

The phenotypic characteristics of rainbow trout from four geographically distinct Great Lakes areas are compared and found to show differences. These differences are probably due to variations in environmental conditions, particularly temperature during early stages of development. Samples from the Lake Erie watershed were taken from North Creek (42°58' N, 80°37' W). (SM)

68. Bidgood, B. F. and A. H. Berst. 1969. Lethal temperatures for Great Lakes rainbow trout. J. Fish. Res. Bd. Can. 26(2):456-459.

Samples of progeny from wild rainbow trout (Salmo gairdneri) homing to four widely separated Great Lakes watersheds (Lake Erie being one), when incubated and reared under similar conditions and acclimated to 15° C, did not differ in tolerance to upper lethal temperatures. The size of the individual fish under test did not affect the resistence time. The similar response of the four samples to upper lethal temperatures complements the conclusions previously reported from phenotypic observations of wild and cultured trout from the same four watersheds.

Bigelow, N. K. - See: Wilbert A. Clemens, No. 170.

69. Bigelow, N. K. 1922. Representative Cladocera of Southwestern Ontario. Ont. Fish. Res. Lab. Pub. 8. pp. 111-125.

Sampling for Cladocera was conducted in 1919 and 1920 throughout the waters of Ontario. Lake Erie and ponds on Point Pelee were included in the survey. Forty-nine species are recorded along with a brief note on each. Diagrams of 27 species are included. (CCIW)

70. Bissell, John M. 1889. Whitefish in the Great Lakes. Trans. Am. Fish. Soc. 18:9-10.

A short article announcing the re-establishment of whitefish in Lake Erie through artificial propagation and planting. (BU)

71. Black, H. H. and L. F. Oeming. 1951. Survey of industrial wastes in the Lake Huron-Lake Erie section of the international boundary waters. Part 2. United States section. Sewage and Industrial Wastes. 23(4):517-535.

A description of the industrial waste program conducted as part of the survey is presented. The paper explains pertinent factors having bearing on the industrial pollution constituents studied and summarizes the results of two special studies indicating the progress in pollution control during the survey period. Thirty-nine United States industries which discharge wastes to boundary waters or tributaries were studied. (BECPL)

72. Blackwell, Will H. Jr. 1970. The Lythraceae of Ohio. Ohio J. Sci. 70(6):346-352.

The distribution of Ohio representatives of the family Lythraceae was studied by examination of all specimens of this family in ten in-state and one out-of-state herbaria. Six species of the Lythraceae were found to be native to Ohio and are discussed: *Decodon verticillatus*, *Rotala ramosior*, *Ammannia coccinea*, *Peplis diandra*, *Lythrum dacotanum*, and *Cuphea viscosissima*. Three introduced taxa are also deemed worthy of inclusion: *Lythrum hyssopifolia*, *L. salicaria*, and *Lagerstroemia indica*.

In terms of Lake Erie, the following genera were reported as occuring along the shoreline areas: *Decodon verticillatus*, *Rotalia ramosior*, *Ammannia coccinea*, *Lythrum dacotanum* and *Lythrum salicaria*.

Blakeslee, Clifford L. - See: Imogene C. Strickler Robertson, et al, No. 666.

Bligh, E. G. - See: J. F. Uthe, No. 809.

73. Bligh, E. G. 1970. Mercury contamination in fish. In: A Summary of the Material Presented at the Twentieth Annual Institute of Public Health Inspectors. Winnipeg, Manitoba. pp. 10-19.

A general discussion of mercury contamination including an analysis of the mercury content in the fish of Canadian waters.

74. Bligh, E. G. 1971. Environmental factors affecting the utilization of Great Lakes fish as human food. Limnos. 4(1):13-18.

A discussion of the effects of environmental degradation on the utilization of fish as human food. Lake Erie is mentioned in the context of mercury and pesticide contamination of fish.

75. Blum, John L. 1965. Interactions between Buffalo River and Lake Erie. Univ. Mich. Great Lakes Res. Div. Proc. 8th Conf. on Great Lakes Res. Pub. 13:25-28.

1964 data on temperature and conductivity of Buffalo River and receiving waters are reported. Although the river for some of its length is clearly polluted and toxic, such conditions are probably more severe close to the surface than on the bottom. Definite indications from many parameters show substantial improvement in the river well above its mouth. During the summer the river is thermally stratified due to the accession of warm industrial wastes. Dilution of lower portions of Buffalo River by the waters of Lake Erie is probably a key factor in rendering those portions of the river as well as most of Buffalo Harbor habitable to tolerant benthic organisms.

76. Bodola, Anthony. 1966. Life history of the gizzard shad, Dorosoma cepedianum, (Le Sueur), in Western Lake Erie. U. S. Fish and Wildlife Service. Fish. Bull. 65(2):391-425.

The rapid increase in the stocks of gizzard shad in Lake Erie since 1950 unquestionably had an important effect on the ecology of the lake. The present study, based on almost 24,000 fish collected by various means in 1952-55 in or near the island area of Western Lake Erie was undertaken to provide information on the role of shad in the bionomics of the region. The age, seasonal growth, weight, length and anatomy of the digestive tract are discussed.

Boesel, M. W. - See: V. E. Shelford, No. 701.

77. Boesel, M. W. 1937. The food of nine species of fish from the western end of Lake Erie. Trans. Am. Fish. Soc. 67:215-223.

A study of the specific nature of the food of various fishes in Western Lake Erie. The fish species represented are basically insect eaters. (CCIW)

78. Boesel, M. W. 1948. Holoconops in the Western Lake Erie region (Diptera: Heleidae). Ohio J. Sci. 48(2):69-72.

A single female of Holoconops catawbae n. sp. was collected on a Lake Erie beach while in the act of biting the author's arm. Since the specimen was identified as a new species of Holoconops, a complete taxonomic description is presented. (BU)

79. Boesel, M. W. 1972. The early stages of Ablabesmyia annulata (Say) (Diptera, Chironomidae). Ohio J. Sci. 72(3):170-173.

The larva of Ablabesmyia annulata is remarkably similar to Malloch's Tanypus sp. A. briefly described in 1915. It differs from other American species in the following characteristics: 3 inner teeth of lingua truncate, all claws of posterior prolegs yellow, and both anterior and posterior prolegs apically and densely armed with spinules. In the pupa, the respiratory organ is smooth and ovate, lacking a terminal papilla. The respiratory opening is distinctly preapical. The species is widely distributed in Ohio.

80. Boulton, Patricia and Leo J. Hetling. 1972. A statistical analysis of the mercury content of fresh water fish in New York State. N.Y. State Dept. Env. Cons. Albany, N.Y. Tech. Rept. 19. 16 p.

A report on an extensive program undertaken by New York to collect basic data on the concentration of mercury in the state's environment. Thirty-two hundred fish were collected and analyzed. Included is a statistical analysis of the fish data.

81. Bowman, Edgar W. 1974. Lake Erie bottom trawl explorations, 1962-66. U.S. Dept. Commerce. Seattle, Wash. NOAA Tech. Rept. NMFS-SSRF-674. 21 p.

The Bureau of Commercial Fisheries (now the National Marine Fisheries Service) Exploratory Fishing and Gear Research Base, at Ann Arbor, Mich., surveyed the abundance, availability to the otter (bottom) trawl, and depth distribution of various Lake Erie fish stocks between April 1962 and October 1966. The four exploratory cruises, conducted aboard the research vessel Kaho, clearly demonstrated the effectiveness of the bottom trawl in producing commercial quantities of yellow perch, Perca flavescens, and rainbow smelt, Osmerus mordax. Freshwater drum, Aplodinotus grunniens; carp, Cyprinus carpio; channel catfish, Ictalurus punctatus; and

white bass, Roccus chrysops, were all produced in commercial quantities at least once during the study and collectively accounted for 17.1% of the total landings.

Between the first exploratory cruise in 1962 and the last in 1966 the abundance of yellow perch decreased significantly, and that of alewife, Alosa pseudoharengus, increased dramatically.

Braidech, Lawrence L. - See: Charles E. Herdendorf, No. 348.

82. Braidech, Thomas E., Philip E. Gehring and Conrad O. Kleveno. 1971. Biological studies of oxygen depletion and nutrient regeneration processes in the Lake Erie Central Basin. Internat. Assoc. Great Lakes Res. Proc. 14th Conf. on Great Lakes Res. pp. 805-817.

See also: Braidech, T., P. Gehring and C. Kleveno. 1972. Biological studies related to oxygen depletion and nutrient regeneration processes in the Lake Erie Central Basin. In: Noel M. Burns and Curtis Ross (Eds.), Project Hypo: An Intensive Study of the Lake Erie Central Basin Hypolimnion and Related Surface Water Phenomena. U.S.E.P.A. Tech. Rept. TS-05-71-208-24. pp. 51-70.

Algae found on the sediment in the Central Basin of Lake Erie during the summer of 1970 were predominantly Tribonema and Oedogonium. The algae were of planktonic origin and exhibited growth on the bottom after light became limiting for other sedimented forms. A reduced sediment oxygen demand indicates sedimented algae contributed oxygen to the hypolimnion for a period of time. The reduction of incident light available to the algae on the sediment, the result of increased plankton in the epilimnion and decreased photoperiod with the approach of the autumnal equinox, increases the rate of oxygen consumption. Respiring bacteria in the degradation of dead algae utilize the remaining oxygen in the hypolimnion. Nutrients regenerated from the sediments as a result of oxygen depletion in the hypolimnion became available to algae as reflected by increased growths of Anacystis in and near the thermocline.

83. Braidech, Thomas E., Philip E. Gehring and Conrad O. Kleveno. 1972. Biological studies related to oxygen depletion and nutrient regeneration processes in the Lake Erie Central Basin. In: Noel M. Burns

and Curtis Ross (Eds.), Project Hypo: An Intensive Study of the Lake Erie Central Basin Hypolimnion and Related Surface Water Phenomena. U.S.E.P.A. Tech. Rept. TS-05-71-208-24. pp. 51-70.

See also: Braidech, Thomas E., Philip E. Gehring and Conrad O. Kleveno. 1971. Biological studies of oxygen depletion and nutrient regeneration processes in the Lake Erie Central Basin. Internat. Assoc. Great Lakes Res. Proc. 14th Conf. on Great Lakes Res. pp. 805-917.

See Abstract No. 82.

84. Brain, Charles K. 1913. A preliminary list of the acarina of Cedar Point. Ohio Nat. 13(6):131.

A list of 25 acarina (mites) collected between July 20 and August 15, 1912, at Cedar Point is given. (BU)

Brinkhurst, Ralph O. - See: M. G. Johnson, No. 404.

85. Brinkhurst, Ralph O. 1965. Studies on the North American aquatic Oligochaeta. II: Tubificidae. Proc. Acad. Nat. Sci. Philadelphia. Philadelphia, Penn. 117(4):117-172.

Forty-four species known from North America are described and figured, and a key is erected for their identification. The following genera were collected from Lake Erie: Limnodrilus, Peloscolex, Euilyodrilus and Branchiura.

86. Brinkhurst, Ralph O. 1969. Changes in the benthos of Lakes Erie and Ontario. In: Robert A. Sweeney (Ed.), Proceedings of the Conference on Changes in the Biota of Lakes Erie and Ontario. Buffalo Soc. Nat. Sci. Bull. Buffalo, N. Y. 25(1):45-71.

One of the more striking features of the chironomid fauna of Lake Erie is the marked difference in species composition that occurs in different parts of the lake. A number of environmental factors have undoubtedly contributed to this, but the distributions of many of the species appear to be intimately related to the progressively more eutrophic conditions encountered towards the western end of the lake.

Only five genera were collected in the Western Basin of Lake Erie, all being tolerant of the eutrophic conditions. In

contrast, 14 genera were collected in the Eastern Basin, including several forms considered as indicative of oligotrophic conditions. The fauna in the Central Basin was intermediate.

87. Brinkhurst, Ralph O. and David G. Cook. 1966. Studies on the North American aquatic Oligochaeta. III: Lumbriculidae and additional notes and records of other families. Proc. Acad. Nat. Sci. Philadelphia. Philadelphia, Penn. 118(1):1-33.

The Lumbriculidae thus far recorded from North America are described and a key for their identification is provided. Preliminary notes for a revision of the Aeolosomatidae and Haplotaxidae are presented, together with the descriptions of species in the Naididae and Tubificidae recorded since the publication of Parts I and II of this study. Some amendments to the earlier descriptions are given. The following genera were collected from Lake Erie: Tubifex, Psammoryctides, Limnodrilus, Peloscolex, Euilyodrilus and Aulodrilus.

88. Brinkhurst, Ralph O., A. L. Hamilton and H. B. Herrington. 1968. Components of the bottom fauna of the St. Lawrence Great Lakes. Univ. Toronto. Great Lakes Inst. Toronto, Ont. PR 33. 50 p.

Bottom fauna were sampled during synoptic cruises through Georgian Bay, Lake Ontario, and Lake Erie and distributions of their major components determined. Oligochaeta, sphaeriidae, and chironomidae were separated. Identity of species and their distribution is discussed. Reference is made to other Great Lakes studies on benthos. Samples representing all seasons were included where possible. Results are presented in taxonomic groups and distribution maps. Maps of depth profiles, indicating degree of oxygen depletion in Lake Erie in summer, and bathymetrical maps are included. 31 species of tubificidae from the Great Lakes and some in Canadian lakes are recorded. In grossly polluted situations, the number of oligochaetes is very high. Species of the sphaeriidae identified in the Great Lakes Institute collection are listed. The taxa of chironomidae, reasonably complete in assessment of the profundal and sublittoral fauna, from these three lakes are listed. To facilitate comparison between these lakes a measure of the 'trophic conditions' of each area was calculated according to ability to withstand eutrophic conditions, providing numerical values which aid in the comparisons of various bodies of water. Key to tubificidae is given.

89. Britt, N. Wilson. 1955. _Hexagenia_ (Ephemeroptera) population recovery in Western Lake Erie following the 1953 catastrophe. Ecology. 36(3):520-522.

Bottom samples made in 1954 (June) from areas in Western Lake Erie where the _Hexagenia_ population had been entirely wiped out in 1953 by low oxygen concentrations revealed that the mayfly was again inhabiting the area. This study gives two possible explanations for this phenomenon: (1) nymphs migrated from shallower waters back to these areas, or (2) they hatched from dormant eggs which had remained in the area during the stratification in the autumn of 1953.

90. Britt, N. Wilson. 1955. New methods of collecting bottom fauna from shoals or rubble bottoms of lakes and streams. Ecology. 36(3):524-525.

A discussion of a new method for collecting benthic organisms which utilizes a concrete block with an attached buoy. (BU)

91. Britt, N. Wilson. 1955. Stratification in Western Lake Erie in summer of 1953: Effects on the _Hexagenia_ (Ephemeroptera) population. Ecology. 36(2):239-244.

Benthic samples collected in the summer of 1953 showed a marked reduction of _Hexagenia_ (mayfly) population along with unusual thermal stratification and low dissolved oxygen concentrations.

92. Britt, N. Wilson. 1965. A brief note on the distribution of the polychaete, _Manayunkia speciosa_ Leidy, in Western Lake Erie. Ohio J. Sci. 65(4):175-176.

Contains a brief presentation of the occurrence and distribution of the polychaete, _Manayunkia_, collected in the vicinity of Put-in-Bay, Ohio.

93. Britt, N. Wilson and James T. Addis. 1966. Limnological studies of the island area of Western Lake Erie, 1959-1965. Ohio State Univ. Nat. Resources Inst. Spec. Rept. 147 p.

Physical, chemical and biological studies were made of the island region of Lake Erie. The results are discussed and compared with data from earlier studies. The conclusion is reached that the entire Western Basin of Lake Erie has undergone drastic and adverse changes in recent years.

94. Brooks, Stanley T. 1932. Freshwater medusae. Science. 76(1977):465.

A brief note concerning the Craspedacusta ryderi found in a reservoir in Allegheny County, Pennsylvania. It is thought that they originated in Lake Erie and were transported to the reservoir with fish from the lake. (SM)

95. Brown, C. J. D., Clarence Clark and Bruce Gleissner. 1938. The size of certain naiades from Western Lake Erie in relation to shoal exposure. Am. Mid. Nat. 19(3):682-701.

During this study over 1,000 specimens were collected. The measurements of 8 species are presented. Three habitats were used for collection of species: protected; moderately exposed; and extremely exposed. Besides the individual variations found for each species and age group within each habitat, there are consistent differences in the average size and weight of age classes among the three habitats. The degree of stunting in Lake Erie for all species studied is definitely correlated with the degree of exposure found in the habitats, with the more stunted individuals found in the more exposed lake habitats. (SM)

96. Brown, Edward H. Jr. and Clarence F. Clark. 1965. Length-weight relationships of northern pike, Esox lucius, from East Harbor, Ohio. Trans. Am. Fish. Soc. 94(4):404-405.

Length-weight relationships between the two sexes of northern pike were determined from samples collected in East Harbor, Ohio between the months of March and April during which movements related to spawning reach a peak.

97. Brown, Harley P. 1952. The life history of Climacia areolaris (Hagen), a neuropterous 'parasite' of fresh water sponges. Am. Mid. Nat. 47(1):130-160.

Eggs of Climacia areolaris were collected from Lake Erie waters at Put-in-Bay, Ohio and used to rear the three larval instars and the pupa. Descriptions and figures of each stage of the life cycle are included in this paper. The ecological factors affecting distribution, abundance, reproduction, and the relationships of Climacia to other organisms are also considered. (BU)

98. Bruce, J. P. 1970. Water pollution and the role of the Canada Centre for Inland Waters. Can. Geog. J. 80(6):182-193.

The role of the Canada Centre for Inland Waters in controlling the quality of Canada's waters is discussed. Lake Erie is specifically mentioned in context to various types of contamination (bacterial, viral, organic and thermal) and their effects on water fauna and flora.

99. Bruemmer, Fred. 1966. Lake Erie gull colony. Can. Audubon. Can. Audubon Soc. Toronto, Ont. 28(1):13-17.

A report on the changing bird population of Mohawk Island near Port Maitland, Ontario. In the early 1940's common terns (<u>Sterno hirundo</u>) dominated the three-acre island. In 1943 the ring-billed gulls had only twenty-six nests on the island. Ten years later they had more than 1,000. Differences in behavior between terns, herring gulls and ring-billed gulls are noted. (SM)

100. Brydges, Thomas Gerald. 1971. Chlorophyll <u>a</u> - total phosphorus relationships in Lake Erie. Internat. Assoc. Great Lakes Res. Proc. 14th Conf. on Great Lakes Res. pp. 185-190.

This study reveals evidence that suggests that if the total phosphorus concentration is reduced there will be less chlorophyll <u>a</u> and hence less algae.

101. Brydges, Thomas Gerald. 1971. An intensive biochemical survey in Western Lake Erie. Internat. Assoc. Great Lakes Res. Proc. 14th Conf. on Great Lakes Res. pp. 191-197.

Incorporated in this biochemical survey of Western Lake Erie is a study of a possible symbiotic relationship between algae and bacteria. Findings of an inverse relationship between chlorophyll <u>a</u> concentrations and bacterial numbers suggests that this is not the case.

102. Bubna, M. 1902. Coleoptera of Cuyahoga, Ohio. Ohio Nat. 2(4):193-197.

Contains a list of the genera and species of Coleoptera found in Cuyahoga County, Ohio. (BU)

Burdick, George E. - See: Irene S. Pakkala, et al, No. 619, 620.
Raymond J. Lovett, et al, No. 489.

103. Burkholder, James Arthur. 1973. Natural resources management in the Great Lakes Basin. New York State Sea Grant Program. Albany, N. Y. 172 p.

This publication is one of a series concerned with solving the natural resources management problems of the Great Lakes Basin. The history of the Great Lakes Fishery Commission is briefly reviewed. Mention is made of changes in lake biology which have resulted from waterway developments. Avenues have been provided for exotic species to enter the upper Great Lakes. The Welland Canal allowed the lamprey and alewife to circumvent Niagara Falls and enter Lake Erie. This single factor has had a great impact on the Great Lakes fishery.

104. Burkholder, Paul R. 1929. Biological significances of the chemical analysis. In: Charles J. Fish (Ed.), Preliminary Report on the Cooperative Survey of Lake Erie, Season of 1928. Buffalo Soc. Nat. Sci. Bull. Buffalo, N. Y. 14(3):65-72.

The relationship between nitrogen, oxygen, carbon dioxide, and hydrogen ion content of the waters of Eastern Lake Erie and organic life is discussed.

105. Burkholder, Paul R. 1929. Microplankton studies of Lake Erie. In: Charles J. Fish (Ed.), Preliminary Report on the Cooperative Survey of Lake Erie, Season of 1928. Buffalo Soc. Nat. Sci. Bull. 14(3):79-93.

Studies of the microplankton life of Lake Erie were undertaken as part of the general biological survey during the summer of 1928. The objects of this particular phase of the work were the following: (1) To find out more about the kinds and quantity of micro-organisms existent in the lake; (2) To determine something of their distribution, both vertically and horizontally, and their seasonal variation during the period covered by these investigations; (3) To discover something of their economic significance in the economy of the lake, more particularly as regards their bearing on the problem of fish production. Chemical analyses and physical observations were made on all the regular plankton collecting trips. It was hoped that the evidence so obtained might make the plankton findings more meaningful.

106. Burkholder, Paul R. 1929. Microplankton studies of Lake Erie. In: Charles J. Fish (Ed.), A Preliminary Report on the Joint Survey of Lake Erie. A Biological Survey of the Erie-Niagara System. N. Y. Dept. Cons. Suppl. 18th Ann. Rept. (1928). pp. 60-66.

Studies of the microplankton life of Lake Erie were undertaken as part of the general biological survey during the summer of 1928. The objects of this particular phase of the work were the following: (1) To study the kinds and quantity of micro-organisms existent in the lake; and (2) To determine something of their significance in the economy of the lake, more particularly as regards their bearing on the problem of fish production.

In order to secure representative samples it was necessary to establish a number of stations at various points on the eastern portion of the lake included in this survey. Those stations were chosen which were deemed either biologically significant, i.e., near sources of pollution, outwash from streams, etc., or were significant on account of the depth of the water or their geographical location.

107. Burkholder, Paul R. 1930. A biological survey of Lake Erie. Science. 71(1837):288-289.

A brief article concerning the biological survey of Lake Erie carried out by the U. S. Bureau of Fisheries, Buffalo Society of Natural Sciences, the New York State Conservation Department, the Departments of Fish and Game of Pennsylvania and Ohio, the government of Ontario and the Health Department of the City of Buffalo. The purpose was an inquiry into the reasons for the decline in the commercial fishery industry in the lake. (SM)

108. Burkholder, Paul R. 1960. A survey of the microplankton of Lake Erie. In: Charles J. Fish (Ed.), Limnological Survey of Eastern and Central Lake Erie, 1928-1929. U. S. Fish and Wildlife Service. Spec. Sci. Rept. - Fish. 334. pp. 123-144.

A report on the microplankton of Lake Erie, exclusive of that area west of the island region. Discussed are: species present; their abundance; horizontal and vertical distribution; and seasonal variation.

Burnard, R. K. - See: H. G. Smith, et al, No. 708.

Burns, N. M. - See: A. S. Menon, et al, No. 519.

109. Burns, N. M. and C. Ross. 1971. Nutrient relationships in a stratified eutrophic lake. Internat. Assoc. Great Lakes Res. Proc. 14th Conf. on Great Lakes Res. pp. 749-760.

See also: Burns, N. M. and C. Ross. 1972. Oxygen-nutrient relationships within the Central Basin of Lake Erie. In: Noel M. Burns and Curtis Ross (Eds.), Project Hypo: An Intensive Study of the Lake Erie Central Basin Hypolimnion and Related Surface Water Phenomena. U.S.E.P.A. Tech. Rept. TS-05-71-208-24. pp. 85-119.

Seven intensive chemical surveys of the Central Basin of Lake Erie were carried out at four-day intervals during the month of August 1970. Special emphasis was placed on measuring the oxygen and nutrient levels in the hypolimnion. The volume of the hypolimnion was seen to increase during the study and a model has been developed for the calculation of the quantities of materials transferred into the hypolimnion.

110. Burns, N. M. and C. Ross. 1971. "Project Hypo": A description of an intensive study of the Lake Erie Central Basin hypolimnion and related surface water phenomena. Internat. Assoc. Great Lakes Res. Proc. 14th Conf. on Great Lakes Res. pp. 740-742.

See also: Burns, N. M. and C. Ross. 1972. "Project Hypo": An Introduction. In: Noel M. Burns and Curtis Ross (Eds.), Project Hypo: An Intensive Study of the Lake Erie Central Basin Hypolimnion and Related Surface Water Phenomena. U.S.E.P.A. Tech. Rept. TS-05-71-208-24. pp. 1-2.

Field work was done from June through August 1970. Focus of the study was the phenomenon of oxygen depletion in the Central Basin of Lake Erie during the summer months. Data was collected from 25 water sampling stations, of which 5 were used for intensive sampling for chemical, biological, bacteriological, and physical variables, and 16 additional bathythermograph recording stations.

111. Burns, N. M. and C. Ross. 1971. "Project Hypo": Discussion of findings. Internat. Assoc. Great Lakes Res. Proc. 14th Conf. on Great Lakes Res. pp. 761-767.

The effects of algae build-ups in Lake Erie due to phosphorus input were investigated by depositing algae of planktonic origin intermittently into the hypolimnion and onto bottom sediments of the Central Basin.

Analysis of the data strongly indicates that: (1) Most algae sedimented to the bottom, died and added to the biological oxygen demand in the hypolimnion almost immediately; (2) The surviving genera of algae were under great stress due to unfavorable environmental conditions which caused the respiration rate to exceed the photosynthetic rate most of the time; and, (3) The oxygen produced by the sedimented algae was small in comparison to the oxygen demand created by the expired algae.

The findings of this investigation lead to one definite conclusion: phosphorus input to Lake Erie must be reduced immediately. If this is done, a quick improvement in the condition of the lake can be expected; if it is not done, the rate of deterioration of the lake will be much greater than it has been in recent years.

112. Burns, N. M. and C. Ross. 1972. Oxygen-nutrient relationships within the Central Basin of Lake Erie. In: Noel M. Burns and Curtis Ross (Eds.), Project Hypo: An Intensive Study of the Lake Erie Central Basin Hypolimnion and Related Surface Water Phenomena. U.S.E.P.A. Tech. Rept. TS-05-71-208-24. pp. 85-119.

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in the sediments returns to the overlying water.

113. Burns, N. M. and C. Ross. 1972. Project Hypo: An introduction. In: Noel M. Burns and Curtis Ross (Eds.), Project Hypo: An Intensive Study of the Lake Erie Central Basin Hypolimnion and Related Surface Water Phenomena. U.S.E.P.A. Tech. Rept. TS-05-71-208-24. pp. 1-2.

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114. Burns, N. M. and C. Ross. 1972. Project Hypo: Discussion of findings. In: Noel M. Burns and Curtis Ross (Eds.), Project Hypo: An Intensive Study of the Lake Erie Central Basin Hypolimnion and Related Surface Water Phenomena. U.S.E.P.A. Tech. Rept. TS-05-71-208-24. pp. 120-126.

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115. Burr, Harriet G. 1901. Plant study at Sandusky Bay. Ohio Nat. 1(6):93-94.

This article contains notes of a collecting trip for water plants at Sandusky Bay, Ohio. (BU)

Burris, R. H. - See: T. H. Mague, No. 499.

116. Burt, William H. 1957. Mamals of the Great Lakes Region. Univ. Mich. Press. Ann Arbor, Mich. 246 p.

This book contains seventy-seven maps, one for each species, indicating the distribution of mammals in the Great Lakes region. The text includes a description of each animal, a key for identification, and a list of tooth formulae for skull identification.

Twenty-eight of the species range throughout the area. Of the remaining species, seventeen are southern forms with the northern limits of their ranges in the area. Sixteen are northern with southern limits in the area, eight find their eastern limits, and five their western limits in the area. It is a transition area, especially from north to south. Barriers to distribution seem to be: (1) the Great Lakes for some species; and (2) ecological conditions. (SM)

117. Butrico, F. A., C. J. Touhill and I. L. Whitman (Eds.). 1971. Resource Management in the Great Lakes Basin. Heath Lexington Books. D. C. Heath and Co. Lexington, Mass. 190 p.

A comprehensive analysis of the natural resources of the Great Lakes region. The biological aspects of Lake Erie are discussed. (CCIW)

118. Camin, Joseph H. and Paul R. Ehrlich. 1958. Natural selection in water snakes (Natrix sipedon L.) on islands in Lake Erie. Evolution. 12:504-511.

Data is presented indicating post-natal selection for pattern type in water snakes (Natrix sipedon) on the islands of Lake Erie. Strong selection, demonstrable without regard to selective agent, has produced a shift towards unbanded pattern types on the islands, while constant migration from the mainland has maintained "banded" genes in the island gene pools. These antagonistic pressures have produced a situation unusually amenable to analysis. (BU)

119. Campbell, Douglas H. 1886. Plants of the Detroit River. Bull. Torrey Bot. Club. 13:93-94.

This article contains a list of plants collected near the mouth of the Detroit River in the summer of 1885. (BU)

120. Campbell, Louis W. 1938. Phalaropes of Western Lake Erie region. Auk. 55(1):89-94.

Sightings of three types of phalaropes at the western end of Lake Erie are summarized. They include: (1) the Red Phalarope, noted only in autumn; (2) the Wilson Phalarope, a regular visitor but not numerous; and, (3) the Northern Phalarope, not numerous but seen regularly. Observations were made between May 7 and May 25 and September 7 and October 12. (SM)

121. Campbell, Louis W. 1947. American Egrets nesting on West Sister Island in Lake Erie. Auk. 64:461-462.

A general note recording the discovery of a colony of six nests of the American Egret, _Casmerodius albus egretta_ (Gmelin) on West Sister Island in Lake Erie. Ten nestlings were banded. (SM)

122. Campbell, Louis and Milton B. Trautman. 1936. The status of Forster's tern in the Western Lake Erie region of Ohio and Michigan. Auk. 53(2):213-214.

Forster's tern is reported as a regular visitor to the region but no evidence of nesting was found. Sight records and specimens of this tern for the Western Lake Erie region from 1932 to 1935 are listed. (SM)

123. Canada. 1955. Annual report of the Fisheries Research Board of Canada for the fiscal year ended March 31, 1955. Fish. Res. Bd. Can. Ottawa, Ont. pp. 73-76.

A discussion of the sea lamprey and control measures which are used on the Great Lakes. Lack of suitable spawning streams tributary to Lake Erie has kept the species from becoming plentiful there. The first sea lamprey above Niagara Falls was taken in Lake Erie in 1921. (SM)

124. Canada. 1958. Annual report of the Fisheries Research Board of Canada for the fiscal year ended March 31, 1958. Fish. Res. Bd. Can. Ottawa, Ont. 195 p.

This report mentions research on improved methods of killing sea lamprey. One new technique, tested on a tributary of Lake Erie, was a direct current installation to guide fish

and lampreys into a trap where they could be sorted and the lamprey killed. Reports from the fishing industry on Lake Erie showed that yellow perch, yellow and blue pickerel, whitefish, white bass and smelt were being caught. (SM)

125. Canada. 1962. Annual report of the Fisheries Research Board of Canada for the fiscal year ended March 31, 1962. Fish. Res. Bd. Can. Ottawa, Ont. p. 93.

Observations were made in the Welland Canal in 1959 and 1961 to determine whether sea lampreys used that waterway extensively for migrations between Lake Ontario and Lake Erie. The canal was emptied after navigation closed in December and observations made. Thirteen species of fish were found, including the white perch, Roccus americanus. No lampreys were collected. (SM)

126. Canada. 1968. Annual report 1967. Fish. Res. Bd. Can. Ottawa, Ont. 17 p.

Aquatic insect larvae belonging to one family were analyzed in detail in over 1,000 dredge samples from Lake Erie, Lake Ontario, and Georgian Bay. The results confirm the existence of eutrophic conditions in the western end of Lake Erie. The genera in the eastern end of Lake Erie are more diversified and indicate a much lower degree of eutrophication. One small aquatic organism, an indicator of clean oligotrophic waters, was characteristic of samples from Georgian Bay, and to a lesser extent of those from Lake Ontario and the eastern end of Lake Erie. (SM)

127. Canada. 1969. Annual report 1968. Fish. Res. Bd. Can. Ottawa, Ont. 17 p.

The abundance of algae in the Great Lakes was measured to define present patterns of eutrophication and establish base lines for assessing the effectiveness of future remedial measures. The distribution and abundance of chironomid larvae in Georgian Bay, Lake Ontario and Lake Erie was used as the basis for a new index of the productivity level. (SM)

128. Canada. 1971. Annual report 1970. Fish. Res. Bd. Can. Ottawa, Ont. 24 p.

Lakewide studies on the effect of nutrient addition on the waters of Lakes Erie and Ontario showed that addition of phosphate and nitrate brought about the most pronounced responses

in terms of algae growth, but with markedly varying results depending on locality and time of year. The effect of phosphate addition appeared to be more pronounced in Lake Ontario than Lake Erie.

Chironomids and other insect remains, in a sediment core from the Western Basin, showed increased eutrophication in the upper part of the core.

Experimental fertilization of a small lake in northwestern Ontario, at a rate corresponding to loading rates for phosphorus and nitrogen in Lake Erie, resulted in phytoplankton population increases of 10 times the first year, and 15-25 times the second year. (SM)

129. Canada. 1973. Annual report 1972. Fish. Res. Bd. Can. Ottawa, Ont. 32 p.

This report mentions a linear relationship in Lake Erie between chlorophyll _a_ concentrations and photosynthetic carbon uptake by planktonic algae. In 1970 the average concentration of chlorophyll _a_ in the Western Basin of Lake Erie was 1.4 times that of the Central Basin, and 2.8 times that of the Eastern Basin. Algal production followed a pattern similar to that for chlorophyll _a_; per unit of surface area, production was slightly higher in Lake Erie than in Lake Ontario. (SM)

130. Canada Centre for Inland Waters. Undated. Annual Report - 1968. Dept. Energy, Mines and Resources. Fish. Res. Bd. Dept. National Health and Welfare. Burlington, Ont. 30 p.

The Fisheries Research Board studied the biological aspects of Great Lakes pollution. A large number of _Daphnia longiremis_ were found during a study of zooplankton in Lake Erie. This form was previously unrecorded in the lake.

131. Canada Centre for Inland Waters. Undated. Lake Erie cruise 69-101, February 6-27; cruise 69-103, May 29-June 4; cruise 69-104, July 2-6; cruise 69-105, July 28-August 2, 1969. Can. Oceanographic Data Centre. Burlington, Ont. Limnological Data Rept. 1. 101 p.

One of a series of reports listing bacteriological, biological, chemical, and physical data for the waters of Lake Erie

observed by Canadian agencies during the period February 6 to December 13, 1969. (CCIW)

132. Canada Centre for Inland Waters. Undated. Lake Erie cruise 69-107, August 25-30; cruise 69-108, September 13-18; cruise 69-110, October 14-20; cruise 69-111, December 7-13, 1969. Can. Oceanographic Data Centre. Burlington, Ont. Limnological Data Rept. 2. 140 p.

One of a series of reports listing bacteriological, biological, chemical and physical data for the waters of Lake Erie observed by Canadian agencies during the period February 6 to December 13, 1969. Water quality data gathered on eight monitoring cruises are included in these reports. (CCIW)

133. Canada Centre for Inland Waters. 1969. Lake Erie cruise 66-11, August 8-14, 1966. Can. Oceanographic Data Centre. Burlington, Ont. Limnological Data Rept. 8. 105 p.

This report contains limnological data gathered for research and monitoring purposes, primarily to provide data required in connection with the International Joint Commission reference on pollution of Lakes Erie and Ontario. A summary of the data collected is presented in tabular form. (CCIW)

134. Canada Centre for Inland Waters. 1970. Annual report - 1969. Dept. Energy, Mines and Resources. Dept. National Health and Welfare. Burlington, Ont. 40 p.

A new device to separate zooplankton from filamentous algae was devised by a member of the Fisheries Research Board staff. A contract was awarded to the University of Guelph to assess the estuarial waters of the Grand River. One area for study was the productivity with respect to bottom fauna, plankton, and nekton including energy transfer.

135. Canada Centre for Inland Waters. 1970. Lake Erie cruise 67-101, May 30-June 7; cruise 67-102, June 12-18; cruise 67-103, June 19-29, 1967. Can. Oceanographic Data Centre. Burlington, Ont. Limnological Data Rept. 1. 230 p.

This report is one of a series listing chemical, bacteriological and physical data observed by Canadian agencies.

Bacteriological data was obtained from two out of three cruises. Cruise 67-101 extended from May 30 through June 7 and covered 153 stations located throughout the lake. No bacteriological data is given for cruise 67-102. Cruise 67-103 extended from June 19 through June 29 and covered 167 sampling sites located throughout the lake.

136. Canada Centre for Inland Waters. 1970. Lake Erie cruise 67-104, July 4-9; cruise 67-105, July 10-19; cruise 67-107, July 31-August 9, 1967. Can. Oceanographic Data Centre. Burlington, Ont. Limnological Data Rept. 2. 186 p.

This report is one of a series listing chemical, bacteriological and physical data for waters of Lake Erie observed by Canadian agencies. Ten cruises of Lake Erie were carried out between May 30 and October 30, 1967. Work was done aboard the 140-foot sterntrawler, Brandal. Bacteriological data is contained in this report. (CCIW)

137. Canada Centre for Inland Waters. 1970. Lake Erie cruise 67-109, August 21-31; cruise 67-111, September 11-21; cruise 67-113, October 2-9; cruise 67-115, October 23-29, 1967. Can. Oceanographic Data Centre. Burlington, Ont. Limnological Data Rept. 3. 226 p.

This report is one of a series listing chemical, bacteriological and physical data for waters of Lake Erie observed by Canadian agencies. Ten cruises of Lake Erie were carried out between May 30 and October 30, 1967. (CCIW)

138. Canada Centre for Inland Waters. 1970. Lake Erie cruise 68-102, May 17-24; cruise 68-104, June 15-19; cruise 68-108, July 29-August 3, 1968. Can. Oceanographic Data Centre. Burlington, Ont. Limnological Data Rept. 1. 152 p.

This report is one of a series listing chemical, bacteriological, biological and physical data for waters of Lake Erie observed by Canadian agencies during the period May 17 to November 10, 1968. These surveys are designed to provide data for determining optimum pollution abatement and water management programs for the Great Lakes. (CCIW)

139. Canada Centre for Inland Waters. 1970. Lake Erie cruise 68-109, August 31-September 3; cruise 68-111, September 28-October 4; cruise 68-112, November

4-10, 1968. Can. Oceanographic Data Centre. Burlington, Ont. Limnological Data Rept. 2. 140 p.

This report is one of a series listing chemical, bacteriological and physical data observed by Canadian agencies. Bacteriological data was obtained from two out of three cruises. Cruise 68-109 covered 33 stations located in the Western and part of the Central Basins. No bacteriological data is given for cruise 68-111. Cruise 68-112 covered 87 sampling stations located throughout the lake.

140. Canada Centre for Inland Waters. 1971. Canada Centre for Inland Waters - 1970. Dept. Fish and Forestry. Burlington, Ont. 53 p.

The causes, effects and extent of oxygen depletion in the bottom waters of the Central Basin of Lake Erie were investigated between May and November 1970. The study showed that the tremendous algal blooms which occurred used up all the available phosphorus in the surface waters, and on sinking to the bottom and decaying, rendered an area of more than 1,000 square miles of bottom waters completely devoid of oxygen. It was also found that significant regeneration of phosphates from the decaying algae and from sediments occurred in the anoxic area, but that this was not the case if measurable dissolved oxygen concentrations were present.

141. Canada Centre for Inland Waters. 1972. Canada Centre for Inland Waters - 1971. Dept. Env. Burlington, Ont. 87 p.

A report on the investigations of the phyto- and zooplankton of Lakes Erie and Ontario conducted throughout 1971 is presented. Comparisons are made between the two lakes and also between the three Basins of Lake Erie.

142. Canada Centre for Inland Waters. 1972. Canada Centre for Inland Waters - 1972. Dept. Env. Burlington, Ont. 125 p.

A review of the work undertaken by the Canada Centre for Inland Waters during 1972 is presented. Included is a report on the microbiological water quality of the Grand River and other Ontario waters. The project goals are the establishment of parameters most suitable for microbiological

water quality assessment, seasonal effect on bacterial and chemical parameters, optimal sampling frequency and minimum number of samples required for establishing the water quality of a specific body of water.

Also included is a comparative analysis of the zooplankton of Lakes Erie, Huron, and Ontario. First order estimates of standing crop biomass have been calculated from estimates of zooplankton abundance in the three lakes.

143. Canada Inland Waters Branch. 1970. The control of eutrophication. Dept. Energy, Mines and Resources. Ottawa, Ont. Tech. Bull. 26. pp. 1-10.

An analysis of data revealed that carbon is rarely a critical growth-limiting element in lakes, nitrogen is of more importance, and phosphorus, in most cases, is the critical and controlling factor in eutrophication. The data was collected from various lakes in Canada including Lake Erie.

Carpenter, G. F. - See: N. H. F. Watson, No. 852.

144. Carpenter, G. F., E. L. Mansey and N. H. F. Watson. 1974. Abundance and life history of Mysis relicta in the St. Lawrence Great Lakes. J. Fish. Res. Bd. Can. 31(3):319-325.

A report on a sampling program for Mysis relicta in the St. Lawrence Great Lakes in 1971. Comparative abundances were obtained for four of the lakes, including Lake Erie, with the same sampling gear on several cruises from spring to fall. Attempts were made to determine life history patterns from size analysis of the catches. (SM)

Carpenter, Michael L. - See: Michael W. Fall, et al, No. 252.

145. Carr, John F. 1962. Dissolved oxygen in Lake Erie, past and present. Univ. Mich. Great Lakes Res. Div. Proc. 5th Conf. on Great Lakes Res. Pub. 9:1-14.

This article deals with dissolved oxygen in Lake Erie and mentions its effect on mayfly (Hexagenia) population, as well as that of certain species of fish.

146. Carr, John F., Vernon C. Applegate and Myrl Keller. 1965. A recent occurrence of thermal stratification and low dissolved oxygen in Western Lake Erie. Ohio J. Sci. 65(6):319-327.

This article deals with the areas of thermal stratification and dissolved oxygen in Western Lake Erie and mentions their effects on mayfly (Hexagenia) populations.

147. Carr, Richard L., Charles E. Finsterwalder and Michael J. Schibi. 1972. Chemical residues in Lake Erie fish - 1970-1971. Pestic. Monit. J. 6(1):23-26.

Yellow perch, coho salmon, channel catfish, freshwater drum, and white bass from the Ohio shore of Lake Erie were analyzed during 1970-71 for residues of chlorinated pesticides (DDE, TDE, DDT, and dieldrin), polychlorinated biphenyls (PCB's), and mercury.

148. Case, Frederick W. Jr. 1964. Orchids of the western Great Lakes region. Cranbrook Inst. Sci. Bloomfield Hills, Mich. Bull. 48. 148 p.

A field guide with identification keys, diagrams, descriptions and ecological notes. Photographs taken in the field illustrate each species. Distribution maps are included and indicate which species are found near Lake Erie and on the Lake Erie islands. (SM)

149. Casper, Victor L. 1965. A phytoplankton bloom in Western Lake Erie. Univ. Mich. Great Lakes Res. Div. Proc. 8th Conf. on Great Lakes Res. Pub. 13:29-35.

On 9 and 10 September 1964, biologists at the Great Lakes-Illinois River Basins Project's Lake Erie Program Office investigated a blue-green algal bloom in Western Lake Erie. The bloom, consisting primarily of Anacystis cyanea, Oscillatoria sp., Carteria sp., Aphanizomenon holsaticum and Anabaena circinalis, covered approximately 800 square miles and appeared densest around the island area. Plankton and chemical samples were collected from top, middle, and bottom depths, and color photographs were made during the survey.

During the day dissolved oxygen was at or above saturation. Total nitrogen was high and nitrate very low. Plankton counts were quite variable. Early in the morning the algae was well dispersed top to bottom due to light wind, but by afternoon it was concentrated in the upper 2 feet, forming a dense scum. On 11 September high winds were followed by several cloudy days, and the bloom was not observed again.

Chandler, David C. - See: Alfred M. Beeton, No. 61.
J. S. Marshall, et al, No. 506.

150. Chandler, David C. 1940. Limnological studies of Western Lake Erie. I. Plankton and certain physical-chemical data of the Bass Islands region, from September, 1938, to November, 1939. Ohio J. Sci. 40(6):291-336.

Year-round limnological data based on weekly collections in the region of the Bass Islands, Lake Erie, are presented. Emphasis is placed on seasonal variation of centrifuged phytoplankton, net zooplankton, and certain physical and chemical conditions characteristic of the region. Data in this paper suggest that turbidity influences the quality and quantity of light available at various depths for photosynthesis, which in turn may influence the time, duration, and size of phytoplankton pulses. (BU)

151. Chandler, David C. 1942. Limnological studies of Western Lake Erie. II. Light penetration and its relation to turbidity. Ecology. 23(1):41-52.

This report concluded that, biologically, turbidity and its variations in Western Lake Erie may influence (1) composition, size, duration and time of occurrence of phytoplankton pulses; (2) rate of photosynthesis at various depths; (3) position of the compensation points of higher aquatic plants and phytoplankters; (4) vertical distribution of microcrustacea; and (5) magnitude of the commercial catch of saugers (Stizostedion canadense). (SM)

152. Chandler, David C. 1942. Limnological studies of Western Lake Erie. III. Phytoplankton and physical-chemical data from November, 1939, to November, 1940. Ohio J. Sci. 42(1):24-44.

Year-round limnological data based on weekly observations of phytoplankton and general physical-chemical factors of Western Lake Erie are presented. The data indicates that when the average turbidity of the water of Western Lake Erie is 25 ppm or greater preceding and during a phytoplankton pulse, the pulse is small and of short duration. Likewise, when the average turbidity is less than 20 ppm preceding and during a pulse, the pulse is large and of long duration. Diatoms compose a greater percentage of the total phytoplankton when the average turbidity exceeds 25 ppm than when it is less than 20 ppm. Conversely, green and blue-green algae

compose a greater percentage of the total phytoplankton when the average turbidity is less than 20 ppm than when it is greater than 25 ppm. (BU)

153. Chandler, David C. 1944. Limnological studies of Western Lake Erie. IV. Relation of limnological and climatic factors to the phytoplankton of 1941. Trans. Am. Micro. Soc. 63(3):203-236.

A study reporting results of year-round limnological studies of Western Lake Erie for the third consecutive year. It is concerned with annual variations in the abundance of phytoplankton and the factors responsible for them. In 1941 the spring phytoplankton pulse was several times larger than any other observed. Diatoms composed 98 percent of the total population and Asterionella was the predominant form. The autumn pulse was larger than those of previous years; greens and blue-greens constituted more than 50 percent of the population. The marked annual variation in the abundance of phytoplankton in Western Lake Erie is intimately related to variations in lake turbidity and water temperature. Turbidity is determined by wind and precipitation and water temperature controlled by wind and solar radiation. (SM)

154. Chandler, David C. and Owen B. Weeks. 1945. Limnological studies of Western Lake Erie. V. Relation of limnological and meteorological conditions to the production of phytoplankton in 1942. Ecol. Mono. 15(4):435-456.

A report on abundance of phytoplankton in Western Lake Erie as it relates to limnological and meteorological conditions. The spring phytoplankton crop (February to mid-April) consisted of 94% diatoms, 4% green algae and 2% blue-greens. The autumn crop (mid-July to November) consisted of 76% diatoms, 4% green algae and 20% blue-greens. During the spring of 1942 high turbidity of the lake water appeared to have controlled the size of the phytoplankton crop. Autumnal phytoplankton production during 1942 is thought to have been reduced by increased rate of eastward movement of lake water, storm-induced mixing of areas of Western Lake Erie, and perhaps the reduced concentration of nutrients. (SM)

155. Chapman, V. J. 1970. Lake eutrophication and biological problems. Explorer. 12(1):18-22.

A general article on the process of lake eutrophication. Reference is made to the average number of algal cells per

milliliter in Lake Erie water at the Cleveland intake. In 1927-29 the count was about 150 cells per ml. In 1962-63 it was approximately 1,750 cells per ml.

Methods suggested for control of eutrophication include regulation of shoreline use, removal of vegetation by mechanical harvesting, and biological means, such as introduction of the Chinese grass carp which is increasingly used in Great Britain and Russia. (SM)

156. Chen, M. and G. Power. 1972. Infection of American smelt in Lake Erie with the microsporidian parasite *Glugea hertwigi* (Weissenberg). Can. J. Zool. 50(9):1183-1188.

In samples taken monthly throughout the year the percentage of American smelt in Lake Ontario and Lake Erie containing cysts of *Glugea hertwigi* was 5.2% and 62.7% respectively. Sexual differences in incidence were observed, the significance of which was uncertain as results from the two lakes were contradictory. In male fish infection was almost entirely restricted to the digestive tract with few cysts in the liver, skin, and testes. In female fish the digestive tract and ovaries were similarly infected. Seasonal fluctuations in *Glugea* infection were obvious and seemed correlated with the gonadal cycle. In both sexes the highest parasite load corresponded with the onset of maturation. A striking difference in fecundity between the two smelt populations was attributed to the *Glugea* infection. In females parasite cysts replaced ovarian tissue, causing a reduction in the number of maturing eggs. (EC)

157. Chiappetta, Jerry. 1968. Great Lakes - great mess. Audubon Mag. (May-June). pp. 30-44.

This article stresses the importance of the Great Lakes to the economy of both the U.S. and Canada. An analysis is made of the causes and possible solutions to the problems of pollution in these five lakes.

Christensen, Ralph G. - See: Jasper Clemente, No. 171.

158. Christie, W. J. 1968. Possible influences of fishing in the decline of Great Lakes fish stocks. Internat. Assoc. Great Lakes Res. Proc. 11th Conf. on Great Lakes Res. pp. 31-38.

The policy of liberalized fish management which has been in effect in the Great Lakes is assessed in the light of the seriously depreciated condition of many of the premium stocks, and with reference to recent information on the over-fishing problem. It is suggested that year class irregularity may result from excessive fishing pressure and that the rebound of a stock is not necessarily to be expected after a collapse. It is proposed that in situations where environmental change is not obviously involved, production difficulties should be dealt with by means of restrictive experimental management.

159. Clapp, George H. 1916. Notes on the land-shells of the islands at the western end of Lake Erie and descriptions of new varieties. Annals Carnegie Mus. Pittsburgh, Penn. 10(3-4):532-540.

A report on seven varieties of shells collected on islands in Western Lake Erie. The collection site, measurements, and description is included for each variety. (SM)

160. Clare, Lawrence G. 1972. Algae and water treatment in the New York section of Lake Erie. State Univ. N.Y. at Buffalo. Civil Eng. Dept. Buffalo, N.Y. M.S. Thesis. 66 p.

A four year study of the plankton population of five Lake Erie raw water intakes in Western New York was conducted from 1968 to 1971. Weekly sampling was carried out to define the principal algae encountered and define the algal cycle with respect to five area water treatment plants. Specific genera and types of algae were correlated with the most significant problems of the plants - shortened filter runs and taste and odor problems. The effectiveness of the various treatment methods for correcting these problems is discussed.

Clark, Clarence F. - See: C. J. D. Brown, et al, No. 95.
Edward H. Brown Jr., No. 96.

161. Clark, Clarence F. 1950. Observations on the spawning habits of the northern pike, Esox luciens, in northwestern Ohio. Copeia. 1950(4):285-288.

In the spring of 1949, 229 northern pike were netted from tributaries of Lake Erie and placed in a pond at the St. Mary's State Fish Farm, Ohio. Also, 821 breeder pike from these streams were stocked in Nettle Lake, Ohio. Observations on spawnings were made at both lakes as well as at several streams in northwestern Ohio. Data on the incubation of eggs were obtained from eggs held in aquaria and in special screen hatchery troughs suspended in St. Mary's hatchery pond. (BU)

162. Clark, Clarence F. 1956. Sandusky River report. Ohio Div. Wildlife. Columbus, Ohio. 67 p.

This report is concerned with fish populations, movements and fish harvests in the Sandusky River. The study was part of the district fishery activities for 1952-1954. There is mention of use of the river as a water supply and for sewage disposal. Tables of fish stocking records from 1938-1954, creel census for 1951-1954, and fish tagging records for 1953-1954 are included.

163. Clark, Clarence F. and Frank Steinbach. 1959. Observations of the age and growth of the northern pike, _Esox lucius_ L., in East Harbor, Ohio. Ohio J. Sci. 59(3):129-134.

Scale samples from 688 northern pike taken from East Harbor, Ohio during March 1951, 1952 and 1953 were used in this study. Growth was calculated on the assumption of direct proportion between scale measurements and lengths of the fish at the time of annulus formation. It was found that growth for individuals of the same age varied, the greatest annual increment was during the first year of life, and sexual dimorphism, females growing faster than males, was evident. (BU)

164. Clark, Frank N. 1885. Results of planting whitefish in Lake Erie. Trans. Am. Fish. Soc. 14:40-50.

Excerpts from a series of interviews of Lake Erie commercial fishermen from Erie, Pa. to Toledo, Ohio. These fishermen testify that their whitefish catch, in almost all cases, has increased substantially in 1884 as compared to earlier years. The reason given for this increase was the artificial propagation program conducted between 1875 and 1878. (BU)

Clay, Edythe E. - See: Bernard S. Meyer, et al, No. 524.

Clay, William M. - See: Roger Conant, No. 176, 177.

165. Clay, William M. 1938. A synopsis of the North American water snakes of the genus _Natrix_. Copeia. 1938(4):173-182.

This article contains a key to the North American forms of _Natrix_. A description of _Natrix sipedon insularum_ Conant and Clay is included. (SM)

166. Clemens, Howard P. 1951. The food of the burbot, Lota lota macalosa (LeSueur), in Lake Erie. Trans. Am. Fish. Soc. 80:56-66.

This study includes results of stomach examinations of 5,253 burbots captured along the north shore of Lake Erie between May, 1946 and May, 1947. Variations in the major food items in relation to method of capture, season, locality, and the length of the burbot are examined. The major food items were evaluated by volume, number of items consumed, and the number of stomachs containing each item. Each criterion of abundance assisted in the determination of the role of the burbot in the food relationship of fish in the lake. (BU)

167. Clemens, Howard P. 1951. The growth of the burbot, Lota lota maculosa (LeSueur), in Lake Erie. Trans. Am. Fish. Soc. 80:163-173.

Growth studies were made on 2,329 Lake Erie burbot collected from May to December, 1946. The data suggests that: burbot shows two types of growth which represent that of the immature and mature fish; females become sexually mature at a length longer than males; and most burbot become sexually mature in their third and fourth years of life when they range from 340 to 440 mm in length. Incidental observations on spawning showed that in 1947 burbot in Lake Erie were spring spawners. Monthly observations throughout a year indicated that the dark outer zone on the otoliths appeared in April and May, shortly after spawning. Clear marginal zones were present for the remainder of the year. (BU)

168. Clemens, Wilbert A. 1922. Hydra in Lake Erie. Science. 55(1426):445-446.

An account of the author's observation of the hydra, identified as Hydra oligactis Pallas, when pound nets were removed from Lake Erie for midsummer replacement and cleaning. Comment is made on the food consumed by the hydra in Lake Erie which might otherwise be eaten by fish. Areas of study are suggested. (SM)

169. Clemens, Wilbert A. 1922. A study of the ciscoes of Lake Erie. Ont. Fish. Res. Lab. Pub. 2. pp. 27-37.

Specimens of ciscoes were taken in 1920 at various points along the northern shore of Lake Erie. Morphological measurements and scale analysis for age are recorded.

Comparisons are made between the species and also between the sampling areas. Growth rates were calculated from the data. (CCIW)

170. Clemens, Wilbert A. and N. K. Bigelow. 1922. The food of ciscoes (Leucichthys) in Lake Erie. Univ. Toronto Studies. Ont. Fish. Res. Lab. Pub. 3. pp. 41-53.

The results of the examination of the contents of the digestive tracts of 211 ciscoes (fresh-water herring), obtained from Lake Erie at various points along the north shore, are presented in tabular form. In addition, 19 individuals from Georgian Bay and 7 individuals from Lake Ontario were examined for comparative purposes.

171. Clemente, Jasper and Ralph G. Christensen. 1967. Results of a recent Salmonella survey of some Michigan waters flowing into Lake Huron and Lake Erie. Internat. Assoc. Great Lakes Res. Proc. 10th Conf. on Great Lakes Res. pp. 1-11.

A salmonella survey was undertaken to gather additional basic bacteriological data regarding the quality of certain Michigan waters. Samples were collected at selected locations via a modified Moore gauze pad technique from the stream effluents of waste treatment plants on the Huron and Raisin Rivers, public bathing waters on Lake Erie in the vicinity of the mouth of the Raisin River, from the intake and stream discharge waters of paper reprocessing plants, and sugar beet processing establishments located on the Raisin and Saginaw Rivers, respectively. The survey spanned a one-year period from January to December of 1966. A total of 57 samples were collected and examined by an elevated temperature technique. Forty-four percent of the samples yielded one or more salmonella serotypes with a total of 23 salmonella serotypes isolated during the survey.

172. Coil, William H. 1954. Contribution to the life cycles of gorgoderid trematodes. Am. Mid. Nat. 52(2):481-500.

A comprehensive study of the gorgoderid trematodes of Lake Erie. Several species, including one new species, are described morphologically and their life cycles are traced. A discussion is given concerning the evolution of gorgoderid cercariae. (BU)

Colby, Peter J. - See: H. F. Lucas Jr., et al, No. 493.

173. Colby, Peter J. 1973. Response of the alewifes, *Alosa pseudoharengus*, to environmental change. In: Walter Chavin (Ed.), Responses of Fish to Environmental Changes. Great Lakes Fish. Lab. Ann Arbor, Mich. Contrib. 472. Chapter 5. pp. 163-198.

A discussion of the behavioral and physiological responses of the alewife to environmental changes in the Great Lakes. The environmental stresses studied were temperature fluctuations and depletion of the food supply. The associated physiological changes included ion imbalance, proliferation of the thyroid and histological changes in the pituitary gland.

174. Commoner, Barry. 1968. Lake Erie aging or ill? Scientist and Citizen. 10(10):254-263, 265.

A review of the changes that have taken place in Lake Erie. Among the factors considered are the changes in fish population due to oxygen depletion, thermal stratification, continued sewage pollution, algal growth, and pesticides. There is discussion of the recommendations in the U.S. Federal Water Pollution Control Administration Lake Erie Report. Emphasis is on the complex inter-relationships between the natural environment of the lake and the uses being made of it by those who live in the basin. (BECPL)

175. Conant, Roger. 1938. The reptiles of Ohio. Am. Mid. Nat. 20(1):1-200.

A study of the reptiles of Ohio collected between 1930 and 1935. The "Oak Openings" area near Toledo, beaches near Portage and along Cedar Point, Catawba and Marblehead penninsulas are areas of special interest. The lake marshes provide habitats for water snakes.

Three forms appear almost exclusively in the lake plains: *Natrix sipedon insularum*, peculiar to the Lake Erie islands; *Elaphe vulpina*, taken only in or near lake marshes; and *Emys blandingii*, common in most counties bordering Lake Erie. Each species is described, its range defined, and there is discussion of its habits and habitat. (SM)

176. Conant, Roger and William M. Clay. 1937. A new subspecies of water snake from the islands in Lake Erie. Univ. Mich. Mus. Zool. Ann Arbor, Mich. Occasional Paper 346. 9 p. + plates.

Description of a distinct geographic race of water snake from the Lake Erie islands with notes concerning its habits and habitat. A total of 669 specimens were examined; most were alive. The pattern of 329 individuals was recorded and scale counts made on 261. The name *Natrix sipedon insularum* is proposed for the snake. (SM)

177. Conant, Roger and William M. Clay. 1963. A reassessment of the taxonomic status of the Lake Erie water snake. Herpetologica. 19(3):179-184.

The taxonomic status of the Lake Erie water snake, *Natrix sipedon insularum* was challenged resulting in a re-examination of data used in making the classification and the study of 204 additional specimens. It was concluded that the *Natrix sipedon insularum* is a valid race readily distinguishable from *Natrix sipedon sipedon*. (SM)

Cook, David G. - See: Ralph O. Brinkhurst, No. 87.

178. Cooke, G. Dennis (Ed.). 1969. The Cuyahoga River watershed. Kent State Univ. Inst. Limnology. Kent, Ohio. 143 p.

A report on an extensive examination of the biological, chemical, physical and socio-economic characteristics of the Cuyahoga River watershed. The areas mentioned were studied and reported on by various investigators.

179. Cornell Aeronautical Laboratory, Inc. 1972. Assessment of the environmental effects accompanying upland disposal of polluted harbor dredgings, Fairport Harbor, Ohio (Appendix A - Supporting Data and Calculations). Cornell Aeronautical Lab., Inc. Buffalo, N.Y. Tech. Rept. CAL. NC-5191-M-1. 42 p.

Analysis of sediments from four sampling stations at Fairport Harbor, Ohio showed coliform counts of 140 - 10,000 (colonies/ 100 ml) before filtering through Whatman No. 541 filter paper. None were found after filtering. Tests for chemical parameters were performed.

180. Couch, John H. 1922. The rate of growth of the whitefish (Coregonus albus) in Lake Erie. Ont. Fish. Res. Lab. Pub. 7. pp. 99-107.

The rate of growth of the whitefish of Lake Erie was determined by plotting curves between the age ascertained from scale samples and the length and weight determined by direct measurement. Whitefish specimens were collected at various points along the northern shore of Lake Erie. (CCIW)

Cowell, Bruce C. - See: Jacob Verduin, et al, No. 842.

181. Coyle, Elizabeth E. 1930. The algal food of Pimephales promelas (Fathead minnow). Ohio J. Sci. 30(1): 23-35.

A description of the food of the fathead minnow with special emphasis on the algal food. Mention is also made of animal forms and other materials found in the alimentary canal. The data gathered shows that this fish species consumes more plant than animal substances. The algal species found in the alimentary canal depended upon the habitat of the fish as well as the size of the fish's gill rakers. (BU)

182. Creaser, Charles W. 1932. The lamprey Petromyzon marinus in Michigan. Copeia. 1932(3):157.

A brief article dealing with the appearance of the lamprey in Lake Erie and its spread to the western shores of the lake. The author predicts the eventual penetration of all the Great Lakes by the lamprey. (BU)

Curnow, R. D. - See: R. D. Hoffman, No. 363.

Curtis, Lamont W. - See: George D. Simpson, No. 703.
George D. Simpson, et al, No. 704.

183. Cutler, N. L. 1929. The biological investigation of pollution in the Erie-Niagara watershed. In: A Biological Survey of the Erie-Niagara System. N.Y. State Cons. Dept. Albany, N.Y. Suppl. 18th Ann. Rept. (1928). pp. 134-139.

Conditions of pollution in Cattaraugus Creek, Rush Creek, and the Lake Erie shore from Buffalo to the New York-Pennsylvania state line were determined by examination of samples taken from these regions. When applicable the specific industry discharging contaminants has been identified.

184. Dahl, Arve H. 1962. Water pollution in the Great Lakes. In: Howard J. Pincus (Ed.), Great Lakes Basin - A Symposium Presented at the American Association for the Advancement of Science, 23-30 December 1959. Washington, D.C. Pub. 71. pp. 277-290.

An overview of pollution problems around the Great Lakes. Water supply, beaches, and sewage disposal are mentioned in connection with the Lake Erie cities of Detroit, Toledo, Cleveland and Buffalo. (SM)

185. Daiber, Franklin C. 1950. Notes on the spawning population of the freshwater drum (Aplodinotus grunniens Rafinesque) in Western Lake Erie. Am. Mid. Nat. 50(1):159-171.

The following observations were made on the spawning population of the freshwater drum in Western Lake Erie during the course of an investigation in 1948 and 1949: (1) The male sheepshead begins to mature at 4 years of age with an average length of 242 mm SL and the female at 5 years with an average length of 307 mm SL; (2) The drop in weight between gonad weight and total body weight serves as an indicator for commencement of the spawning season; (3) The majority of females examined produced between 2 and 4 hundred thousand eggs; and (4) A statistical treatment of two 1948 collections of the young of the year fish reveals that these collections were made up of at least four different size groups and this is considered an indicator that at least four distinct subgroups of adults spawned in the open lake. (SM)

186. Daiber, Franklin C. 1952. The food and feeding relationships of the freshwater drum, Aplodinotus grunniens Rafinesque, in Western Lake Erie. Ohio J. Sci. 52(1):35-46.

A portrayal of the food habits of the sheepshead and how they effect the relationships with other organisms. This study was conducted from 1947 to 1948 in Sandusky Bay, the mouth of the Portage River, and around the islands of Western Lake Erie. Included is a diagramatic interpretation of the food web in Western Lake Erie using the sheepshead as the climax organism. (SM)

187. Daiber, Franklin C. 1953. Notes on the spawning population of the freshwater drum (Aplodinotus grunniens Rafinesque) in Western Lake Erie. Am. Mid. Nat. 50(1):159-171.

A study of the freshwater drum conducted in Western Lake Erie during 1948 and 1949. Included are observations concerning the age at sexual maturity, seasonal changes in the limits of the spawning season, and the presence of subgroups in the spawning population. (BU)

188. Dambach, Charles A. 1960. Status of biological research in waters of Lake Erie. Univ. Mich. Great Lakes Res. Div. Proc. 3rd Conf. on Great Lakes Res. Pub. 4:109-113.

A presentation by the author giving historical background on the biological research of the Ohio waters of Lake Erie. The type of work undertaken by researchers of the Franz T. Stone Laboratory is summarized along with a listing of the agencies which support this research. (RL)

189. Dambach, Charles A. 1969. Changes in the biology of the lower Great Lakes. In: Robert A. Sweeney (Ed.), Proceedings of the Conference on Changes in the Biota of Lakes Erie and Ontario. Bull. Buffalo Soc. Nat. Sci. Buffalo, N.Y. 25(1):1-17.

Dramatic biological changes have appeared in bottom fauna and among certain fishes of the lower Great Lakes. Of special significance is the abundant increase, since 1959, of the midge Procladius, a supposedly more pollution-tolerant form, while Chironomus promosus has decreased suggesting that pollution zones have extended further into the lakes. The mayfly is now rare. Benthic fauna is now dominated by oligochaetes and midges, with some fingernail clams, snails, and leeches on the increase. Species composition, once dominated by diatoms, are now dominated by blue-green algae. Decline of certain high quality fishes, notably the blue pike and walleye pike, is largely responsible for the accelerated public interest in corrective measures.

Davies, Clara A. - See: Malcolm M. Stickney, et al, No. 745.

190. Davis, Charles C. 1953. Cleveland Harbor industrial pollution study. In: Lake Erie Pollution Survey. Ohio Dept. Nat. Resources. Div. Water. Columbus, Ohio. pp. 170-188.

A study of the industrial pollution of the Cleveland Harbor and Cuyahoga River areas of Lake Erie. This study was conducted from September, 1950 to September, 1951. Emphasis is placed on the chemical and physical aspects of the problem although the effects of the pollution on various organisms are discussed.

191. Davis, Charles C. 1954. A preliminary study of the plankton of the Cleveland Harbor area, Ohio. II. The distribution and quantity of the phytoplankton. Ecol. Mono. 24(4):321-347.

From September, 1950 through September, 1951 quantitative plankton samples were obtained at the surface and at 6.5 m approximately every two weeks at 9 stations in the Cleveland Harbor area of Lake Erie. The numbers of cells, numbers of coenobia, and volumes/l were determined for the phytoplankters. Total volumes/l of the phytoplankton showed characteristic autumnal and vernal maxima, and winter and summer minima. Nine categories (species or genera) of the Cyanophyta, 11 categories of Diatomaceae, 16 categories of Chlorophyta and 7 categories of "holophytic Mastigophora" are considered in detail. The observed seasonal distribution of each is given, and graphs and tables are given for the more abundant kinds. Comparisons are made between the ecological conditions of the Central Basin and those of the other two basins of Lake Erie, as reported in the literature, in an attempt to gain clues towards an explanation of the differences of phytoplankton production. The needs for further detailed quantitative investigations, especially in the Central and Eastern Basins, and for laboratory culture experimentation are stressed.

192. Davis, Charles C. 1954. A preliminary study of the plankton of the Cleveland Harbor area, Ohio. III. The zooplankton, and general ecological considerations of phytoplankton and zooplankton production. Ohio J. Sci. 54(6):388-408.

During the year September, 1950 through September, 1951, a study was made of the Cleveland Harbor area in connection with a survey of pollution conditions in Lake Erie. It is the purpose of this paper to describe the results of the analysis of the zooplankton obtained in the plankton samples, and in addition to discuss the dynamic interrelations of the plankton and the environment.

193. Davis, Charles C. 1955. Plankton and industrial pollution in Cleveland Harbor. Sewage and Industrial Wastes. 27(7):835-850.

Nine stations in the Cleveland Harbor area of Lake Erie were visited every two weeks during the year September, 1950 through September, 1951. Quantitative plankton samples were taken from the surface and from a 6.5 m depth at each station. The quantity of plankton was uniformly small at stations where the iron content was greatest. Since this is also true of unpolluted waters, the standing crop is not a reliable index of pollution in locations such as the one under study. (BECPL)

194. Davis, Charles C. 1959. Damage to fish fry by cyclopoid copepods. Ohio J. Sci. 59(2):101-102.

Dead fish taken from Put-in-Bay, Ohio in 1958 were observed to have from five to seven cyclopoids clinging to them; cause of death of the fry could not be determined. Rockbass fry were collected and placed in a tank with five specimens of Mesocyclops edax. The copepods attacked the fry causing damage to its caudal and ventral fins. These observations are reported and discussed. (BU)

195. Davis, Charles C. 1959. Osmotic hatching in the eggs of some fresh-water copepods. Biol. Bull. 116(1):15-29.

The hatching process is described for the fresh-water copepods Diaptomus ashlandi, D. siciloides, D. oregonensis, Cyclops bicuspidatus, and Mesocyclops edax. Specimens were collected in Hatchery Bay from mid-June to mid-July 1958. Observations of the hatching procedure were supplemented by experiments designed to test the validity of the osmotic theory of hatching.

196. Davis, Charles C. 1961. Breeding of calanoid copepods in Lake Erie. Verh. Internat. Verein. Limnol. 14:933-942.

Lake Erie is the most productive of the North American Great Lakes, yet the copepods have been studied very little. Previous investigators reported 8 species of calanoids: Limnocalanus macrurus, Epischura lacustris, Diaptomus (Leptodiaptomus) ashlandi, D. (L.) minutus, D. (L.) sicilis, D. (L.) siciloides, D. (Skistodiaptomus) oregonensis, and D. (S.) reighardi. In the present study, all of these species

were encountered except D. reighardi. Samples of the plankton from all three of the basins of the lake were examined. Tables are included which show the progression of the breeding activity for Lake Erie calanoids and the number of eggs per female *Diaptomus*, by month, in the Eastern, Central and Western Basins.

197. Davis, Charles C. 1961. The biotic community in the Great Lakes with respect to pollution. In: Proceedings of the Conference on Water Pollution and the Great Lakes. DePaul Univ. Chicago, Ill. pp. 80-87.

A general analysis of pollution in the Great Lakes and its effect on the biotic community. Lake Erie is dealt with specifically because it is the most studied as well as the most polluted of the five lakes. The author has included descriptions of eutrophic and oligotrophic lakes in both physical and biological terms.

198. Davis, Charles C. 1962. The plankton of the Cleveland Harbor area of Lake Erie in 1956-1967. Ecol. Mono. 32(3):209-247.

Data from three sampling stations, located in the open waters of Lake Erie off Cleveland, Ohio, was gathered every two weeks between September 1, 1956 and October 12, 1957. Sixty-two categories of phytoplankton and fifty-three categories of zooplankton are listed and discussed. Phytoplankton coenobia and cells were counted and estimates were made of the volume in cubic decimillimeters per liter of each species, and of the total phytoplankton volume per liter. Estimates were made of numbers of zooplankters per liter, but not of the zooplankton volume because of irregular shapes and differing sizes. Among the zooplankters, not only species, but age, sex and reproductive state were determined where possible.

The seasonal distribution for each category of phytoplankton is described and comparisons are made with previous publications. The progress of dominant phytoplankton species through the year is discussed. The individual categories of the zooplankton are also considered separately, and their seasonal distribution and reproductive periods described. Comparisons are then made with the findings of other authors. Finally, the relation of the plankton to its ecosystem is discussed.

199. Davis, Charles C. 1964. Evidence for the eutrophication of Lake Erie from phytoplankton records. Limnology and Oceanography. 9(3):275-283.

The Division Avenue Filtration Plant of the Cleveland Division of Water and Heat has undertaken almost daily phytoplankton counts of water samples from Lake Erie since 1919. Data exists for 25 full years and for 7 additional partial years between 1919 and 1963. There has been a consistent increase in the average quantity of phytoplankton. The vernal and autumnal phytoplankton maxima have consistently become more intense and have lasted longer. The periods of minimum phytoplankton development in winter and summer have become shorter and less well marked, until the winter minimum failed to develop at all in some of the latest years. Certain marked qualitative changes also have occurred. These effects are thought to have been caused by an increasingly rapid eutrophication of the water in Lake Erie.

200. Davis, Charles C. 1965. The standing stock of phytoplankton in Lake Erie at Cleveland, Ohio, 1964. Info. Bull. Planktology Japan. 12:51-53.

The Division Avenue Filtration Plant of the Cleveland Division of Water has undertaken almost daily phytoplankton counts of water samples from Lake Erie since 1919. The purpose of these counts was to ascertain the rate at which filters used in the preparation of the Cleveland water supply could be expected to clog with cells and coenobia of phytoplankters occurring in the intake water. The present paper examines the results obtained during 1964 and compares them with the previous data.

201. Davis, Charles C. 1966. Biological research in the Central Basin of Lake Erie. Univ. Mich. Great Lakes Res. Div. Proc. 9th Conf. on Great Lakes Res. Pub. 15:18-26.

Most of the limited scientific work that has been accomplished in the Central Basin of Lake Erie has been closely associated with practical matters, and hence has dealt mainly with hydrology, fisheries, the search for commercially useful sand deposits, shore erosion, or pollution. Aside from commercial fish-catch data, the only long-term records that have been published are for the phytoplankton of the Cleveland area. There has been a consistent increase of phytoplankton over the years, suggesting a rapid eutrophication of the water. A 1964 study shows an extensive area in the Central Basin where the oxygen content of the bottom waters was very low,

or even lacking. A study that had been made in 1929 had failed to uncover any indication of low oxygen except in the immediate vicinity of large cities. An unpublished 1964 investigation of the benthos indicates predominance of pollution-tolerant forms over most of the Central Basin. Extensive previous studies, however, do not exist with which the 1964 results could be compared.

202. Davis, Charles C. 1966. Plankton studies in the largest great lakes of the world (with special reference to the St. Lawrence Great Lakes of North America). Univ. Mich. Great Lakes Res. Div. Pub. 14:1-36.

The purpose of the present report is to survey critically and in detail the plankton investigations, exclusive of studies of primary production, that have been accomplished to date in the St. Lawrence Great Lakes of North America, to compare these results with those obtained from certain others among the largest lakes of the world, and to suggest fruitful avenues for further study.

203. Davis, Charles C. 1968. The July 1967 zooplankton of Lake Erie. Internat. Assoc. Great Lakes Res. Proc. 11th Conf. on Great Lakes Res. pp. 61-75.

Twenty-seven vertical tows were obtained along a longitudinal transect near the center of Lake Erie. Quantitative estimates were made of the number per m^3 of each species. There were distinct differences among the three basins. The Western Basin had a greater variety and number of rotifers and cladocerans than the other basins, several species being confined there. There were, however, fewer cyclopoid copepods, although *Cyclops vernalis* was seen only in the Western Basin. Other species occurring solely or mainly in the Western Basin included *Synchaeta stylata*, *Brachionus angularis*, *Bosmina coregoni*, *Daphnia retrocurva*, and *Diaptomus siciloides*. The Central Basin contained enormous numbers of *Vorticella* sp., correlated with abundance of *Anabaena*. The cladoceran *Holopedium gibberum* also was confined largely to the Central Basin. Cyclopoid copepods, especially *Cyclops bicuspidatus*, were distinctly more abundant there than elsewhere. The very common rotifer, *Polyarthra vulgaris*, was most abundant in the Eastern Basin, whereas most other species were least common there. The total number of zooplankters per m^3 was greatest in the Western Basin and smallest in the Eastern Basin, confirming previous judgments, which, however, were unsupported by detailed quantitative studies of zooplankton samples taken at the same time and in the same manner in all three basins.

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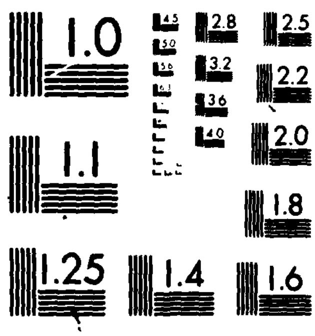

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204. Davis, Charles C. 1969. Lake Erie's shore and water. In: G. Dennis Cooke (Ed.), The Cuyahoga River Watershed. Kent State Univ. Inst. Limnology. Kent, Ohio. pp. 121-134.

A general discussion of the biological characteristics of Lake Erie and its tributaries. Changes in the lake's flora and fauna are emphasized.

205. Davis, Charles C. 1969. Plants in Lakes Erie and Ontario, and changes of their numbers and kinds. In: Robert A. Sweeney (Ed.), Proceedings of the Conference on Changes in the Biota of Lakes Erie and Ontario. Bull. Buffalo Soc. Nat. Sci. Buffalo, N.Y. 25(1):18-44.

A review of the changes in vegetation in Lakes Erie and Ontario. Effects of the introduction of foreign species of fish, siltation and changes in native animal populations on vegetation are discussed. Comment is made on the increased nutrient content of Lake Erie water. Suggestions are also made concerning research needs.

206. Davis, Charles C. 1969. Seasonal distribution, constitution, and abundance of zooplankton in Lake Erie. J. Fish. Res. Bd. Can. 26(9):2459-2476.

Zooplankton samples, collected by vertical hauls from near bottom to the surface, were obtained from 28 stations along the length of Lake Erie in October 1967. A partial similar series, confined largely to the Western Basin because of ice conditions, was collected in January 1968. The results of the analyses are tabulated as numbers of individuals per m^3, and are discussed. Comparisons are made with results previously published for a comparable series of stations visited in July 1967.

207. Davis, Charles C. and Harland B. Roney. 1953. A preliminary study of industrial pollution in the Cleveland Harbor area, Ohio. I. Physical and chemical results. Ohio J. Sci. 53(1):14-30.

A discussion of the extent and effects of industrial river effluents in the Cleveland Harbor area. It was found that these pollutants were deleterious to aquatic life in the river. Also, productivity was reduced and fish were either driven away or poisoned. (BU)

208. Day, D. F. 1883. Plants of Buffalo and its vicinity. Bull. Buffalo Soc. Nat. Sci. Buffalo, N.Y. 4:65-279.

A report on plants found within a fifty mile radius of Buffalo. There is a description of sphagnum bogs found along the northern shore of Lake Erie near Point Abino. A catalogue of plants found in the region is included. (SM)

209. Dean, George W. 1890. Distribution of the Uniondae in the three rivers, Mahoning, Cuyahoga, and Tuscarawas. Nautilus. 4:20-22.

A report on the author's observations of the distribution of Uniondae in three Ohio rivers. The forms Anodonta, Margaratana and Unio, are listed as occurring in the Cuyahoga River. (SM)

210. Deason, Hilary J. 1933. Preliminary report on the growth rate, dominance, and maturity of the pikeperches (Stizostedion) of Lake Erie. Trans. Am. Fish. Soc. 63:348-360.

Comparison of growth of walleyes, blue pike, and sauger. Includes data on dominance of the 1926 year class and on size at maturity for the three species. (CCIW)

Dechtiar, Alex O. - See: Stephen J. Nepszy, No. 549.

211. Dechtiar, Alex O. 1965. A new distribution record for Myxosoma scleroperca Guilford, 1963 (Sporozoa; Myxosomatidae) in yellow perch of Lake Erie. Can. Dept. Fish. Ottawa, Ont. Can. Fish Cult. Issue 34. pp. 31-34.

Myxosoma scleroperca was found in the sclerotic cartilage of yellow perch from Canadian waters of Lake Erie during 1961-1963 investigations. The degree of infestation of Lake Erie perch is compared to Guilford's data for Green Bay perch. It was concluded that since the development of M. scleroperca is not dependent upon an intermediate host, and since yellow perch are currently abundant in Lake Erie, the rate of infestation with this parasite will probably continue to increase.

212. Dechtiar, Alex O. 1965. Preliminary observations on Glugea hertwigi, Weissenberg, 1911 (Microsporidia;

Glugeidae) in American smelt, Osmerus mordax (Mitchill) from Lake Erie. Can. Dept. Fish. Ottawa, Ont. Can. Fish Cult. Issue 34. pp. 35-38.

Glugea hertwigi, Weissenberg (1911), was first noted in Lake Erie smelt in 1960. Its occurrence is given for the years 1960 through 1964.

213. Dechtiar, Alex O. 1967. Neodiscocotyle carpioditis n. gen., n. sp., monogenetic trematode (Discotylidae: Neodiscocotylinae subfam. n.) from the gills of the quillback, Carpiodes cyprinus (LeSueur) of Lake Erie. Can. J. Zool. 45(4):473-478.

A new species of discocotylidian, Neodiscocotyle carpioditis, from the gills of the quillback from Lake Erie is described. A new subfamily, Neodiscocotylinae, and a new genus, Neodiscocotyle, are erected to accommodate this new species. (BU)

214. Dechtiar, Alex O. 1967. Neoechinorhynchus carpoidi n. sp. (Acanthocephala: Neoechinorynchidae) from quillback of Lake Erie. Can. J. Zool. 46(2):201-204.

A new species of acanthocephalan, Neoechinorhynchus carpoidi, from Carpiodes cyprinus (LeSueur) is described. It is the eighth species of the genus Neoechinorhychus reported from North American fishes in which there was marked diversification of the lemnisci. The new species has the longest trunk length of any acanthocephalan previously known from North American fishes. Twenty-five percent of the 48 fish were infected with from two to seven parasites per fish. Inflammation of surrounding tissue was observed together with a prominent connective tissue nodule around the penetrating proboscis. (BU)

215. Dechtiar, Alex O. 1972. New parasite records for Lake Erie fish. Great Lakes Fish. Comm. Ann Arbor, Mich. 20 p.

During 1961-1969 inclusive, 1,112 fish representing 46 species, were examined for parasites. Fish were taken mainly from the Port Dover area in the eastern end, and from the Wheatley area in the western end of Lake Erie. Ninety-six percent of the fish were infected by at least one species of parasite. This study adds 96 new records, including several new species, to the parasite fauna of Lake Erie fish, bringing the present known total to 215 species.

216. DeKay, James E. 1842. Zoology of New York, or the New York Fauna. Part III. Reptiles and Amphibians. Carroll and Cook. Printers to the Assembly. 98 p.

The soft shelled turtle, Trionyx ferox, and the banded proteus, or big water lizard, Menobranchus lateralis, are the species specifically described as being found in Lake Erie. (SM)

217. DeKay, James E. 1842. Zoology of New York, or the New York Fauna. Part IV. Fishes. Carrol and Cook. Printers to the Assembly. 415 p.

Four hundred forty species are included with detailed descriptions of 294. Those attributed to Lake Erie include: the black huron, Huro nigricans; yellow pike-perch, Lucioperca americana; freshwater bass, Centrarchus aeneus; lake sheepshead, Corvina oscula; Great Lake catfish, Pimelodus nigricans; common catfish, Pimelodus catus; mullet sucker, Catostomus aureolus; muskellunge, Esox estor; brook trout, Salmo fontinalis; Mackinaw salmon, Salmo amethystus; whitefish, Coregonus albus; common shad salmon, Coregonus clupeiformis; Buffalo bony pike, Lepisosteus bison; spotted burbot, Lota maculosa; and lake sturgeon, Acipenser rubicundus. (SM)

218. DeKay, James E. 1843. Zoology of New York, or the New York Fauna. Part V. Mollusca. Carroll and Cook. Printers to the Assembly. 271 p.

An extensive description of Molluska found in New York State. Emphasis is on description and classification with mention of the general area in which the specimen has been found. (SM)

219. DeKay, James E. 1844. Zoology of New York, or the New York Fauna. Part VI. Crustacea. Carroll and Cook. Printers to the Assembly. 70 p.

A report on crustacea found in New York. Emphasis is on description and classification. There is mention of areas in which the specimens have been found. Lernea cruciata is identified as a parasite of the Lake Erie rock bass. (SM)

Derksen, A. J. - See: Robert G. Ferguson, No. 258.

220. deRoth, Gerardus C. 1965. Age and growth studies of channel catfish in Western Lake Erie. J. Wildlife Manage. 29(2):280-286.

Left pectoral spines were collected from 1,478 channel catfish taken in Western Lake Erie during 1957 to 1959. Age assessments and growth calculations were made. Spine radius measurements were found to correlate very closely with total lengths. At least 50% of the catfish are mature by the time they reach total lengths ranging from ten to twelve inches with females maturing at a smaller size than do males. Fifty percent or more of both sexes are mature by the end of their fifth year of life. There is no difference between the length-weight relationships of the sexes nor is there any significant difference between the rate of linear growth in the two sexes until the age of maturity is reached. (BU)

221. DeVos, Antoon. 1964. Range changes of birds in the Great Lakes region. Am. Mid. Nat. 71(2):489-502.

This paper reviews the literature dealing with range fluctuations, retractions and extensions, in the Great Lakes region. Environmental changes including removal of forest cover, development of farm lands, provision of various new cultivated crops, overshooting, and drainage of wetlands have all helped to bring about the changes. Amelioration of the climate has also had a decisive influence. The black-backed gull (Larus marinus) is mentioned as extending its range from the east to Lakes Erie and Huron. (SM)

222. Dewey, Chester. 1856. List of naiades (clams) found in Western New York and sent to the State collection at Albany, with some chiefly from Ohio. In: 9th Annual Report on the Condition of the State Cabinet of Natural History with Catalogues of the Same. Regents of the State of New York. Albany, N.Y. pp. 31-38.

Forty-three species of naiades are listed, but only Unio rubiginosus Lea is attributed to Lake Erie. (SM)

223. Dexter, Ralph W. and Edward C. Kinney. 1954. A record of the earthworm, Sparganophilus eiseni, from the basin of Western Lake Erie. Ecology. 35(2):289.

A brief account of the dates and collection sites of Sparganophilus from the island area of Western Lake Erie. (BU)

224. Dingell, John D. 1966. Great Lakes pollution. In: The Great Lakes - How Many Masters Can They Serve. Mich. Nat. Resources Council. 11th Ann. Conf. Lansing, Mich. pp. 19-26.

This paper is a general discussion of pollution of the Great Lakes. Mention is made of over-enrichment of the lakes and bacterial pollution of the lakes and tributaries.

D'Itri, F. M. - See: C. S. Annett, et al, No. 20.
Ronald J. Evans, et al, No. 249.

225. Doan, Kenneth H. 1938. Observations on dogfish (Amia calva) and their young. Copeia. 1938(4):204.

A brief report on the observations made on the habits of the dogfish, including a description of their eggs and nests. Data was collected in June, 1935 at Rondeau Bay, Ontario. (BU)

226. Doan, Kenneth H. 1940. Studies of the smallmouth bass. J. Wildlife Manage. 4(3):241-266.

A study of the smallmouth bass in various waters in the Great Lakes region of Ontario. Specimens taken from Lake Erie were collected at Rondeau Bay and the island region in the Western Basin. This study was concerned with the factors governing the existence of this species and of the ecological relations that influence such activities as feeding, growth, and reproduction. (SM)

227. Doan, Kenneth H. 1941. Relation of the sauger catch to turbidity in Lake Erie. Ohio J. Sci. 41(6):449-452.

Turbidity is an important factor relating to the abundance of certain fishes in Western Lake Erie. A high degree of correlation has existed from 1930 to 1940 between the mean April-May turbidities as measured at Cleveland and the total Ohio sauger catch three years later. Lake turbidities during these months bear a significant relationship to the mean precipitation during these same months. It is suggested that higher turbidities may act to prevent stickiness in sauger eggs, may give young fry protection from predators, and may facilitate the young sauger's feeding by concentrating plankton organisms near the surface. (BU)

228. Doan, Kenneth H. 1942. Some meteorological and limnological conditions as factors in abundance of certain fishes in Lake Erie. Ohio State Univ. Dept. Zool. and Entomology. Columbus, Ohio. Ph.D. Diss. 103 p.

The integration of the individual effects of meteorological and limnological conditions produces fluctuations in fish population densities. Discussed are the temperature, wind, precipitation, turbidity, light, currents, and dissolved substances in the water of Lake Erie and their contributions to the success of spawning, rate of survival of progeny, availability of food, and the conditions involved in migration.

229. Doan, Kenneth H. 1942. Some meteorological and limnological conditions as factors in the abundance of certain fishes in Lake Erie. Ecol. Mono. 12(3):293-314.

By methods of correlation, a survey has been made of the physical factors concerned in the abundance of Lake Erie fishes. It was found that the mean temperatures decrease in order from the southwest to the northeast (same applies to the water temperatures). Mean precipitation varies similarly along Lake Erie, as does turbidity and the latter decreases in value eastward. Turbidity of the lake water depends in part upon the amount of precipitation along the shore. These parameters are correlated to fish catches and occurrences. (SM)

230. Doan, Kenneth H. 1944. The winter fishery in Western Lake Erie, with a census of the 1942 catch. Ohio J. Sci. 44(2):69-74.

The winter fishery in the island region of Lake Erie is described. A census of the 1942 commercial catch is included. The major fish species caught were the pickerel, perch, and sauger. A comparison of the hook and line fishing of Lake Erie and that of other lakes is made. (BU)

231. Doan, Kenneth H. 1945. Catch of *Stizostedion vitreum* in relation to changes in lake level in Western Lake Erie during the winter of 1943. Am. Mid. Nat. 33(2):455.

About the island archipelago in Western Lake Erie there is a hook and line fishery through ice. Fishermen are able to operate for about two months during most seasons, and in recent years have shipped to market an average of nearly 50,000 pounds of fish each winter.

A season's total catch depends upon the nature and extent of the ice cover, which governs the length of the fishing season, upon the number of fishermen, and upon the availability of fish. The latter is in part dependent upon the absolute

number of fish present upon the grounds, and in part upon factors which modify contacts between fish and fishermen, such as water current. The present paper offers the results of a measure of the catch, and the probable nature of changes in catch owing to fluctuations in lake level.

232. Dobson, Hugh H. and Michael Gilbertson. 1971. Oxygen depletion in the hypolimnion of the Central Basin of Lake Erie, 1929 to 1970. Internat. Assoc. Great Lakes Res. Proc. 14th Conf. on Great Lakes Res. pp. 743-748.

Evidence is provided for the progressive eutrophication of Lake Erie. Historic records of dissolved oxygen in the hypolimnion were collected and an average depletion rate was established for each year. The present depletion rate (3.6 mg/l/mo) is more than double the rate estimated for 1929. The rate of deoxygenation has increased at the approximate annual rate of 0.075 mg/l/mo/yr due to increases in phytoplankton production.

233. Dobson, Hugh H. and Michael Gilbertson. 1972. Oxygen depletion in the hypolimnion of the Central Basin of Lake Erie, 1929 to 1970. In: Noel M. Burns and Curtis Ross (Eds.), Project Hypo: An Intensive Study of the Lake Erie Central Basin Hypolimnion and Related Surface Water Phenomena. U.S.E.P.A. Tech. Rept. TS-05-71-208-24. pp. 3-8.

See abstract No. 232.

234. Dostal, Kenneth A. and Gordon G. Robeck. 1966. Studies of modifications in treatment of Lake Erie water. J. Am. Water Works Assoc. 58(11):1489-1504.

The purpose of this paper is to present the results of a one year study in which Lake Erie water was filtered through dual-media filters without flocculators or sedimentation basins at the West Plant, Erie, Pa. Included is an algae count (number per ml) before and after filtration for each of the four seasons included in the study.

235. Downing, Rachel Cox. 1970. Shoreline algae of Western Lake Erie. Ohio J. Sci. 70(5):257-275.

The algae of Western Lake Erie have been extensively studied for more than 70 years, but, until the present study by the author, conducted between April and October, 1967, almost

nothing was known of the shoreline as a specific algal habitat. A total of 61 taxa were identified from the shorelines. The importance of this habitat is very clear from the results of this study, for, of the 61 taxa found, 39 are new records for Western Lake Erie, and one, Arnoldiella conchophila Miller, appears to be a new United States record, having been previously reported only from central Russia.

236. Downing, S. W. 1923. Are we maintaining the supply of whitefish in Lake Erie. Trans. Am. Fish. Soc. 53:62-64.

A brief analysis of the industry concerned with whitefish propagation. Historical data on egg collections is given and the decline of this industry in the western portion of the lake is discussed. (CCIW)

237. Drake, Carl J. 1914. The food of Rana pipiens Shreber. Ohio Nat. 14(5):257-269.

The food of the leopard frog, Rana pipiens Shreber, and its relation to its habitat is discussed. The frogs used in the study were collected from Cedar Point during August. (BU)

Duchene, J. - See: R. M. Pfister, et al, No. 636.

Dugan, Patrick R. - See: David L. Howard, et al, No. 367.
Walter O. Leshniowsky, et al, No. 476, 477.
Robert M. Pfister, et al, No. 634, 635.

238. Dugal, L. C. 1968. Pesticide residue in freshwater fish oils and meals. J. Fish. Res. Bd. Can. 25(1):169-172.

A report on a 1965 investigation by the Fisheries Research Board of Canada during which the pesticide residue content of the alewife, sheepshead, tullibee, and maria was determined. The sheepshead specimens were obtained from Lake Erie. Results showed that DDT and its metabolites accounted for almost all of the pesticide residues in the fish meals and oils.

239. Duncan, Thomas and Ronald L. Stuckey. 1970. Changes in vascular flora of seven small islands in Western Lake Erie. Mich. Bot. Ann Arbor, Mich. 9(3):175-200.

Comparisons were made of the flora of seven small islands in Western Lake Erie. The following observations were recorded: (1) 30-40% of the species on Starve, Hen, Gibralter and Green Islands, 68% of the species on Lost Ballast, 67% of the species on Big Chicken, and all the species on Little Chicken Island have disappeared since 1939; (2) The percentage of annuals and non-indigenous species has increased, while the percentage of perennials and indigenous species has decreased for most of the islands; (3) Of the species that have invaded in the past 30 years, annuals have apparently been more successful in becoming established on the disturbed gravel bar islands, whereas perennials have been most successful in becoming established on the larger islands; (4) The percentage of species new to any island is higher on the small gravel bar islands and lower on the larger islands.

Some of the apparent reasons for these floristic changes are the influences of wave erosion, ice action, fluctuating water levels, and bird inhabitation of the small gravel bar islands. Man's influence and general vegetation succession have been important factors in the floristic change on the larger islands. (SM)

DuPont, P. - See: L. R. Hedrick, et al, No. 344.

Duryea, Richard D. - See: Robert D. MacNish, et al, No. 498.

240. Dutka, B. J., J. B. Bell and D. L. S. Liu. 1974. Microbiological examinations of offshore Lake Erie sediments. J. Fish. Res. Bd. Can. 31(3):299-308.

In August 1972 divers collected cores from the Central and Western Basins of Lake Erie for microbiological analysis. The cores were sectioned and examined for sulfur cycle bacteria, nitrogen cycle bacteria, total heterotrophs, iron oxidizing bacteria, and insoluble organic and inorganic solubilizing bacteria. Eh, nitrogen, organic carbon, and percentage moisture determinations were also made. (SM)

241. Dymond, John R. 1922. A provisional list of the fishes of Lake Erie. Ont. Fish. Res. Lab. Pub. 4. pp. 57-73.

An annotated list of the fishes of Lake Erie containing 91 species of fish and 2 species of lamprey. (CCIW)

242. Dymond, John R. 1932. Records of the alewife and steelhead (rainbow) trout from Lake Erie. Copeia. 1932(1):32-33.

A report on two fish specimens collected at Nanticoke, Ontario on Lake Erie in 1931. These fish were the alewife and steelhead trout. Suggestions as to their possible course of entry to the lake are given. (BU)

243. Dymond, John R. 1957. Artificial propagation in the management of Great Lakes fisheries. Trans. Am. Fish. Soc. 86:384-392.

In discussing the contributions of artificial propagation to the population of Great Lakes fish, several studies conducted in Lake Erie waters are cited. The author notes that no positive evidence has been found to suggest that artificial propagation has ever been successful in significantly increasing the yield of a native species in the Great Lakes. (BU)

Edgington, D. N. - See: M. M. Thommes, et al, No. 766.
H. F. Lucas Jr., et al, No. 493.

Edmondson, W. T. - See: A. M. Beeton, No. 62.

244. Edsall, Thomas A. 1967. Biology of the freshwater drum in Western Lake Erie. Ohio J. Sci. 67(6): 321-340.

Information on the biology of the freshwater drum or sheepshead (Aplodinotus grunniens) was collected in Lake Erie during a fishery and limnological study made by the Bureau of Commercial Fisheries in 1957 and 1958. Growth of the sheepshead in 1958 was slower than in 1927, and slower than the growth in most other waters. Males and females grew at the same rate through the 4th year of life, but thereafter the females grew faster. Males required more than 13 years and females 11 years to reach 17 inches. A weight of 2 pounds was attained in the 12th year of life by males and in the 10th year by females. Annulus formation extended from mid-June to early August for age-groups I-IV (2nd through 5th year of life). Younger fish started growth earlier in the season than the older fish, and the larger, faster growing members of an age group began growth earlier than the smaller fish.

The growing season in 1958 ended in early October. Bottom-water temperatures were about 65°F when growth started (mid-June) and 58°F when growth ended. Growth was most rapid in August when temperatures were highest for the year (72°F). Growth of young of the year, but not that of older fish, was positively correlated with temperature during the 1951-57 growing seasons. The sex ratio of the 1958 samples shifted

with age; age-groups I-IV contained 54% males, but older age groups had 75% males. Males matured between 7.0 and 15.9 inches (age-groups II-V) and females between 9.0 and 13.4 inches (age-groups III-VII). Spawning in 1958 reached a peak in early July, but extended from mid-June to early August.

Ehrlich, Paul R. - See: Joseph H. Camin, No. 118.

245. Ellms, J. W. 1922. A sanitary survey of Lake Erie opposite Cleveland, Ohio - 1920. J. Waterworks Assoc. 9(2):186-207.

A survey for the purpose of selecting a site for a new water intake for the City of Cleveland. Objectives of the survey were: (1) To discover the area of least pollution; and (2) To procure a record of the extent and degree of pollution of the lake water resulting from the discharge of raw sewage. Two sewage treatment plants were being constructed at the time. Conclusions of the study were: (1) Average quality of water in the 4-5 mile zone along the 32 miles investigated was suitable for water supply; and (2) Efficient methods of sewage disposal must be maintained to minimize lake pollution. (BECPL)

246. Enders, Robert K. 1932. Food of the muskrat in summer. Ohio J. Sci. 32(1):21-30.

Contains an annotated list of food plants utilized by the muskrat. (BU)

247. Erie and Niagara Counties Regional Planning Board Utilities Committee. 1973. Environmental assessment statement for the regional water quality management study. Erie and Niagara Counties Regional Planning Bd. Grand Island, N.Y. 273 p.

This publication describes the environmental effects of implementation of a regional sanitary sewage plan in the two-county region. Streams which flow into Lake Erie are described in section V, titled "Environmental Assessments: Lake Erie East End Basin". Surface water quality is evaluated and coliform counts considered. Mention is made of suitable habitats for fish and wildlife in the evaluation of the environmental impact of various alternatives.

248. Erie-Niagara Basin Regional Water Resources Planning Board. 1969. Erie-Niagara Basin comprehensive water resources plan, main report. N.Y. State Water Resources Comm. Cons. Dept. Div. Water Resources. Albany, N.Y. 201 p.

This report presents a comprehensive plan for water resources management and development in the Erie-Niagara Basin. Included is a proposal for the construction of fish passage facilities for the existing Springville Power Dam, designed to permit rainbow trout to reach the upper Cattaraugus stream system. Recommendations are made for fishing rights acquisition and fishing stream improvements on Cattaraugus and Eighteen Mile Creeks.

249. Evans, ..nald J., Jack D. Bails and Frank M. D'Itri. 197?. Mercury levels in muscle tissues of preserved museum fish. Env. Sci. Tech. 6(10):901-905.

Mercury content of several species of fish taken from Western Lake Erie and the Detroit River during 1970 and 1971 is compared with that of preserved museum specimens taken from the same areas prior to 1937 and during the period between 1942 to 1964. The 1970-71 mercury levels were found to be, in most cases, higher than in the preserved museum specimens.

250. Ewers, Lela A. 1933. Summary report of the crustacean used as food by the fishes of the western end of Lake Erie. Trans. Am. Fish. Soc. 63:379-390.

A report on a survey of the stomach contents of twelve species of Lake Erie fish collected in the western end during 1928 and 1929. (CCIW)

Ewing, Howard E. - See: George S. Hunt, No. 385.

251. Fabian, Michael W. 1960. Mortality of fresh-water and tropical fish fry by cyclopoid copepods. Ohio J. Sci. 60(5):268-270.

A report on an experiment designed to test the effects of population density of cyclopoids and of various sizes of fish fry on predation rates. Results indicate that mortality and predation of fry increases as the concentration of the cyclopoids increases. (BU)

Fadow, M. P. - See: C. S. Annett, et al, No. 20.

252. Fall, Michael W., William B. Jackson and Michael L. Carpenter. 1968. The occurrence and origin of small mammals on the islands and peninsulas of Western Lake Erie. Ohio J. Sci. 68(2):109-116.

Collection of small mammals in the island and peninsula region of Western Lake Erie from 1962 to 1967 has provided information on the present distribution of several species. The white-footed mouse (Peromyscus leucopus noveboracensis) was found in wooded areas throughout the region except on two of the smallest islands. Other native small mammals were trapped on Catawba and Marblehead Peninsulas but were not found on any of the islands. Various classical methods by which mice reach islands were considered in reference to the Lake Erie situation. None seemed appropriate for direct movements from mainland to island. Swimming, rafting, and movement across ice may be effective for the shorter inter-island and mainland-to-peninsula movements, but no adequate natural explanation for the longer movements can be offered. Human activity may aid in maintaining mouse populations on the smaller islands, but the limited diversity of island small mammal fauna suggests a minor role for man in the importation of new animals.

253. Farley, John L. 1956. The role of the Great Lakes Fishery Commission in the solution of Great Lakes problems. Trans. Am. Fish. Soc. 86:424-429.

An outline of the role being played by the Great Lakes Fishery Commission in the solution of the major fishery problems in the Great Lakes. Mentioned is the fact that shallow water species comprise the bulk of the commercial catch in the Great Lakes Basin and that 50% of this catch comes from Lake Erie.

254. Farwell, Oliver Atkins. 1925. Botanical gleanings in Michigan. Am. Mid. Nat. 9(7):259-282.

An account of botanical findings in Michigan including mention of areas along the Huron River and the shore of Lake Erie. (SM)

255. Fassett, Norman C. 1940. A Manual of Aquatic Plants. McGraw-Hill Book Co., Inc. New York, N.Y. 379 p.

A comprehensive book intended to assist in the identification of aquatic plants. The Great Lakes region is included in the range of the plants described. An appendix details the use of aquatic plants by wildlife and the relation of plants to fish. (SM)

256. Ferguson, Robert G. 1965. Bathymetric distribution of American smelt Osmerus mordax in Lake Erie. Univ. Mich. Great Lakes Res. Div. Proc. 8th Conf. on Great Lakes Res. Pub. 13:47-60.

Information on the vertical distribution of yearling and older smelt and indications on the distribution of young-of-the-year smelt were obtained with the use of a mid-water trawl in Eastern Lake Erie. In 1964 young-of-the-year were common offshore, and abundant inshore at 10 to 20 feet. Yearlings were abundant near shore in July of 1963. They moved into deeper water in October. Adult smelt were caught below the metalimnion between May and October where they were most often found close to the bottom. During the winter many adults are in water 40 feet and shallower. During their spawning period they move into streams and beaches.

Two 24-hour periods of study during August 1964 revealed a diel vertical distribution of adult smelt. During the day they were concentrated near bottom at 150 feet, but by late afternoon they started to disperse away from bottom. During the night they remained dispersed and invaded the epilimnion. After daylight they again concentrated close to the bottom. Stomach analyses suggested that they fed continuously when near the bottom. Those dispersing to mid-water fed on plankton, but ceased feeding during darkness. In the early morning they fed actively on either plankton or bottom fauna. The amounts and types of food organisms eaten at different times and depths suggest that there may be considerable vertical interchange within the population. The data suggest a thermal preference of 43°F. This did not prevent them invading the epilimnion during the darkness.

257. Ferguson, Robert G. 1969. Key to salmon and trout in the Great Lakes. Ont. Dept. Lands and Forests. Res. Branch. Res. Info. Paper (Fish.) 36. 16 p.

A dichotomous key which presents the characteristics that will permit identification of the salmon and trout of the Great Lakes. (CCIW)

258. Ferguson, Robert G. and A. J. Derksen. 1971. Migrations of adult and juvenile walleyes (Stizostedion vitreum vitreum) in Southern Lake Huron, Lake St. Clair, Lake Erie, and connecting waters. J. Fish. Res. Bd. Can. 28(8):1133-1142.

Recoveries of walleyes (Stizostedion vitreum vitreum) tagged as adults and juveniles at various sites in waters from Southern Lake Huron to Eastern Lake Erie provided information on the migrations of the Thames River stock and the mixing of these fish with other stocks in the study area. Walleyes spawning in the Thames River in March and April quickly migrated into the St. Clair River and Southern Lake Huron, where they mingled with other stocks, including some from Lake Erie. The return migration to the Thames River occurred between November and March. Juvenile walleyes tagged in Lake St. Clair, on the other hand, moved downriver to Lake Erie. Young-of-the-year fish tagged in Western Lake Erie, many presumably of Lake St. Clair origin, provided evidence of a reverse migration, since they tended to move back into Lake St. Clair and Lake Huron as they matured. Adult walleyes tagged along the Canadian shore of Lake Erie migrated eastward during the summer, but were recovered in or near the Western Basin during the spawning season. Thus, Western Lake Erie appeared as a juvenile milling or mixing area during the summer. (SM)

259. Ferguson, Robert G. and Henry A. Regier. 1963. Selectivity of four trawl cod ends toward smelt. Trans. Am. Fish. Soc. 92(2):125-131.

Three short term experiments on selectivity of cod ends with various mesh size for smelt were conducted in Lake Erie during 1961. Estimates of percent retention were obtained from a comparison of length-frequency distributions in catches made with the different cod ends, sampling approximately the same population of smelt on the same date. (CCIW)

Finsterwalder, Charles E. - See: Richard L. Carr, et al, No. 147.

260. Fish, Charles J. (Ed.). 1929. Preliminary report on the cooperative survey of Lake Erie, season of 1928. Bull. Buffalo Soc. Nat. Sci. Buffalo, N.Y. 14(3):7-15, 195-220.

The present report contains a preliminary statement on the results of a three month survey of Eastern Lake Erie to determine the cause or causes for the decline in the fishery.

The program was designed with two objects in view: first, a determination of the natural requirements for successful production, such as the location of the spawning grounds, their relative importance as production centers, the food requirements of the fry, the abundance of this food, enemies, and migrations during the first years of their existence; second, careful tests to determine to what extent man has interfered with these natural requirements, to what degree the waters have been made impossible for fish life, what areas of the bottom have been rendered unfit for spawning, etc. By combining the results of these two lines of study it should be possible to determine where the natural requirements have been most seriously affected and how conditions may best be improved.

261. Fish, Charles J. 1929. A preliminary report on the joint survey of Lake Erie. In: A Biological Survey of the Erie-Niagara System. N.Y. Cons. Dept. Albany, N.Y. Suppl. 18th Ann. Rept. (1928). pp. 39-44.

The present report contains a brief summary of some of the results of a three month survey of Eastern Lake Erie. The object of the investigation was to determine if possible the cause or causes for the decline in the fisheries of the lake. The results are presented as a series of 7 articles by different authors.

262. Fish, Charles J. (Ed.). 1960. Limnological survey of Eastern and Central Lake Erie, 1928-1929. U.S. Fish and Wildlife Service. Spec. Sci. Rept. - Fish. 334. 198 p.

A report on a survey conducted during 1928-1929, the object of which was to ascertain the cause of fishery decline. The investigation was designed to determine the significant physical, chemical and biological conditions in Lake Erie at that time. After extensive study it was concluded that these three factors could afford no explanation for the fishery decline.

263. Fish, Marie Poland, 1929. Contributions of the early life histories of Lake Erie fishes. In: Charles J. Fish (Ed.), Preliminary Report on the Cooperative Survey of Lake Erie, Season of 1928. Bull. Buffalo Soc. Nat. Sci. Buffalo, N.Y. 14(3):136-187.

A record of distribution and description of developmental stages of 67 species of fish taken from Eastern Lake Erie.

264. Fish, Marie Poland. 1929. Contributions of the early life histories of Lake Erie fishes. In: Charles J. Fish (Ed.), A Preliminary Report on the Joint Survey of Lake Erie. A Biological Survey of the Erie-Niagara System. N.Y. Cons. Dept. Albany, N.Y. Suppl. 18th Ann. Rept. (1928). pp. 76-95.

Record of distribution and description of developmental stages of some of the commercially important fish of Lake Erie.

265. Fish, Marie Poland. 1930. Contributions to the natural history of the burbot (Lota maculosa). Bull. Buffalo Soc. Nat. Sci. Buffalo, N.Y. 15(1):1-20.

A study of the burbot in Lake Erie covering development of young, distribution, food and feeding habits, and commercial importance. It is reported that 80 percent of the burbot caught in the United States comes from Lake Erie. (SM)

266. Foell, Eric J. 1974. The age and growth of freshwater drum (Aplodinotus grunniens Rafinesque) from Lake Erie near Cleveland, Ohio. John Carroll Univ. Cleveland, Ohio. M.Sc. Thesis. 95 p.

A report on a study to determine the growth and condition of the freshwater drum in a severely polluted area of Lake Erie off Cleveland, Ohio. The existence of possible effects of pollution on drum growth rates were demonstrated by comparing the results of this study with existing data obtained in less polluted areas of the lake.

267. Forbes, James E. 1970. Environmental deterioration and declining species. N.Y. State Dept. Env. Cons. Albany, N.Y. Conservationist. 25(1):21-26.

A general article reviewing the ways in which species decline due to changes in environment. Factors which are considered include habitat destruction, thermal pollution, chlorinated hydrocarbon pesticides, chemical pollution of water, eutrophication of lakes, dams without fish ladders, air pollution, and solid waste disposal. Particular mention is made of contamination of Lake Erie and other bodies of water by DDT. (SM)

268. Fowler, Henry W. 1907. Records of Pennsylvania fishes. Am. Nat. 41(481):5-21.

A listing of the fish collected in the waters of Pennsylvania including Lake Erie and its tributaries. Collection sites for each species are given. (BU)

269. Fowler, Henry W. 1908. A synopsis on the Cyprinidae of Pennsylvania. Proc. Acad. Nat. Sci. Philadelphia. Philadelphia, Penn. 60(3):517-553.

This paper describes the species of Cyprinidae found in Pennsylvania. Of the 33 species described, only the following are specifically said to have come from Lake Erie or Erie County, Pennsylvania: *Pimephales notatus* (Rafinesque), *Abramis crysoleucas* (Mitchill), *Notropis hudsonius* (Clinton), *Notropis whipplii* (Girard), and *Notropis atherinoides* (Rafinesque). (SM)

Frea, James T. - See: David L. Howard, et al, No. 367.
David L. Howard, et al, No. 368.
Walter O. Leshniowsky, et al, No. 476, 477.
Gail E. Mallard, No. 502.
Patricia M. McCabe, No. 510.
R. M. Pfister, et al, No. 634, 635.
R. M. Pfister, et al, No. 636.

270. Frenette, Roger. 1971. A water quality management strategy for the Great Lakes. Cornell Univ. Water Resources and Mar. Sci. Center. Ithaca, N.Y. Tech. Rept. 34. 221 p.

The purpose of this paper is to develop a strategy, defined as a plan of action, for managing the water quality of the Great Lakes. Included is an assessment of existing water quality in each of the Great Lakes. Total coliform counts for Lake Erie are given for each basin.

271. Frick, Harold C. 1965. Economic aspects of the Great Lakes fisheries of Ontario. Fish. Res. Bd. Can. Ottawa, Ont. Bull. 149. 160 p.

The Lake Erie fisheries have exhibited high productivity throughout their history - the highest productivity per square mile of any of the Great Lakes; the lake offers in its shallowness, warmth, and diversified conditions especially favorable waters for the growth of many species of fish. But

the catch has always been subject to wide fluctuations both in the total poundage and by particular species. Total production for the lake was above 70 million pounds in 1889 and 1890 and again in three of the World War I years. After a gradual decline to 30 million pounds in 1928 and 1929 and a subsequent rise, the volume of catch remained usually between 40 and 50 million pounds until the early 1950's. Production was 75 million pounds in 1956, but in recent years has been closer to the 50 million level. This has constituted about one-half or more than one-half of the total Great Lakes catch - one-third or more of the American landings and 75-85% of the Canadian.

272. Frost, S. L. 1965. Lake Erie pollution survey. Ohio Cons. Bull. 29(3):14-15.

The economic effects of pollution in the Great Lakes on the surrounding areas are stressed. Also included in this article is an outline of a comprehensive study of the Great Lakes water quality with a special study on Lake Erie. The study was just being initiated at the time of this writing.

273. Fruh, E. Gus, Kenton M. Stewart, G. Fred Lee and Gerald A. Rohlich. 1966. Measurements of eutrophication and trends. J. Water Pollution Control Federation. 38:1237-1258.

A review of the parameters used by various investigators to determine the relative state and rate of eutrophication of natural waters. In addition, some of the significant advantages and disadvantages of each of these measurements are discussed. Lake Erie is referred to several times as a site for eutrophic samples.

274. Gachter, R., R. A. Vollenweider and W. A. Glooschenko. 1974. Seasonal variations of temperature and nutrients in the surface waters of Lakes Ontario and Erie. J. Fish. Res. Bd. Can. 31(3):255-290.

During 1970 temperature and nutrient distributions were measured in surface waters of Lakes Ontario and Erie. Nutrient patterns are compared and discussed in relation to temperature, primary production and nutrient sources. (SM)

275. Gaiser, L. O. 1949. Further distribution of *Butomus umbrellantus* in the Great Lakes region. *Rhodera. 51(612):385-*390.

An article reviewing the spread of the European plant, Butomus umbrellantus, from 1941-1949. A distribution map is included. (SM)

Galus, Celia B. - See: Stanley J. Zagorski, No. 880.

276. Gannon, John E. 1969. Great Lakes plankton investigations: a bibliography. Univ. Wisc.-Milwaukee. Center for Great Lakes Studies. Milwaukee, Wisc. Spec. Rept. 7. 65 p.

A bibliography of 430 references concerning Great Lakes plankton. Each paper is annotated in order to elaborate on the titles and to define more clearly the content of the papers.

277. Gannon, John E. and A. M. Beeton. 1969. Studies on the effects of dredged materials from selected Great Lakes Harbors on plankton and benthos. Univ. Wisc.-Milwaukee. Center for Great Lakes Studies. Milwaukee, Wisc. Spec. Rept. 8. 82 p.

Lake Erie stations included in the study are Buffalo, Cleveland, Toledo and the Rouge River. The harbor sediments fit into five categories in terms of their effects on the test organisms: (1) Some sediments were toxic, were avoided by benthic animals, and did not stimulate growth of phytoplankton or Cladophora. Sediments in this category came from Buffalo, Cleveland and the Rouge River. (2) A large number of sediments were toxic to the test animals, but they stimulated the growth of phytoplankton or Cladophora. Sediments in this category came from Buffalo, Cleveland and the Rouge River. (3) Some sediments were only somewhat toxic (i.e. killed some test animals but did not affect others), were avoided by Pontoporeia but not by midge larvae, and stimulated growth of phytoplankton or Cladophora. These sediments were from Cleveland and Toledo. (4) Three sediments from Green Bay (Lake Michigan) were not especially toxic and did not stimulate growth of algae. (5) Three sediments were not toxic and they stimulated growth of phytoplankton but not growth of Cladophora. These were not from Lake Erie harbors.

278. Gannon, John E. and A. M. Beeton. 1971. Procedures for determining the effects of dredged sediments on biota-benthos viability and sediment selectivity tests. J. Water Pollution Control Federation. 43(3):392-398.

Sediment selectivity tests and viability experiments indicated some direct effects on the amphipod, Pontoporeia affinis. Sampling stations were scattered throughout the Great Lakes Region. Every harbor tested had some sediments with mortality greater than the controls. Sediments from the river sections of badly polluted harbors were more toxic than those from the outer harbor. Many dead arthropods were observed to be covered with a film of oil. (BECPL)

279. Gannon, John E. and A. M. Beeton. 1971. The decline of the large zooplankter, Limnocalanus macrurus Sars (Copepoda: Calanoida), in Lake Erie. Internat. Assoc. Great Lakes Res. Proc. 14th Conf. on Great Lakes Res. pp. 27-38.

Limnocalanus macrurus Sars is a large calanoid copepod prominent in the zooplankton fauna of the St. Lawrence Great Lakes. In 1929, it was quite abundant in the Central and Eastern Basins of Lake Erie but was present in the shallow Western Basin only during winter and spring. Some individuals in the Western Basin may have migrated from Lake Huron by way of the St. Clair and Detroit Rivers during winter and spring. Limnocalanus evidently underwent a seasonal dispersal in Lake Erie, since it was confined to the cold hypolimnetic waters of the Eastern and Central Basins during summer, but was distributed throughout the lake from late fall through early spring. Limnocalanus was extremely rare in the Central and Eastern Basins in 1957 but was still present in the Western Basin during spring. No Limnocalanus were found in extensive sampling throughout the lake in 1967 and only a few individuals were observed in 1968. Hypolimnetic dissolved oxygen depletion and predation by planktivorous fish are discussed as the most probable factors involved in the decline of Limnocalanus in Lake Erie.

280. Gary, L. B. 1910. Naiades of Cedar Point, Ohio. Ohio Nat. 10(8):183-184.

A list of 16 species of naiades collected from Cedar Point is given. (BU)

281. Gary, L. B. 1910. Naiades of Grand River, Ohio. Ohio Nat. 10(8):183.

A list of 20 species of naiades collected from the Grand River is given. (BU)

Gehring, Philip E. - See: Thomas E. Braidech, et al, No. 82, 83.

282. Gerrick, David. 1968. A contribution toward a bibliography of Ohio zoology. Ohio State Univ. Columbus, Ohio. Bull. Ohio Biol. Surv. 2(4):1-273.

Included in the bibliography are papers, pamphlets, books, and unpublished manuscripts on the taxonomy, distribution, life history, and ecology of Ohio zoology. All materials listed except those otherwise noted, can be found within the collections of The Ohio State University Libraries or the Ohio State Museum at the state capitol.

Gilbertson, Michael - See: Hugh H. Dobson, No. 232, 233.

283. Giltz, M. L. and W. C. Myser. 1954. A preliminary report on an experiment to prevent cattail die-off. Ecology. 35(3):418.

A brief report of an attempt to protect cattails in Western Lake Erie from carp and muskrats by erecting a one-half inch mesh fence. It was concluded that intermittent preserved areas might offer one way to save the cattails and allow some channels and open areas which are desirable for wildlife management. (SM)

Gleissner, Bruce - See: C. J. D. Brown, et al, No. 95.

Glooschenko, Walter A. - See: R. Gachter, et al, No. 274.
A. S. Menon, et al, No. 519.

284. Glooschenko, Walter A. 1971. The effect of DDT and dieldrin upon ^{14}C uptake by in situ phytoplankton in Lakes Erie and Ontario. Internat. Assoc. Great Lakes Res. Proc. 14th Conf. on Great Lakes Res. pp. 219-223.

In situ studies were performed upon the effects of DDT and dieldrin to phytoplankton in Lake Ontario in May 1970 and Lake Erie in July and October 1970. To water samples, concentrations of 1, 10, 100 and 1000 ppb DDT and dieldrin (Lake Erie only) were added. The response of the phytoplankton was measured by ^{14}C uptake over 5-hr intervals.

The inhibition of ^{14}C uptake by DDT and dieldrin does not appear to be important to the Great Lakes in situ except

possibly in local areas of high run-off from agricultural sources. The major problem appears to be concentration of these pesticides by algae and transfer to higher trophic levels.

285. Glooschenko, Walter A., James E. Moore, Mohiuddin Munawar and R. A. Vollenweider. 1974. Primary production in Lakes Ontario and Erie: a comparative study. J. Fish. Res. Bd. Can. 31(3):253-263.

A comprehensive study of temporal and spatial variations in primary production in Lakes Erie and Ontario. Both surface and integral measurements using the ^{14}C method were made on the lakes to compare their productivity in terms of their trophic status. (SM)

286. Glooschenko, Walter A., James E. Moore and Richard A. Vollenweider. 1974. Spatial and temporal distribution of chlorophyll a and pheopigments in surface waters of Lake Erie. J. Fish. Res. Bd. Can. 31(3):265-274.

Chlorophyll a analysis including pheopigments were made on water samples taken from Lake Erie between April and December 1970. The highest mean chlorophyll a values occurred in the mid-Western Basin; the lowest in the Eastern Basin. Pheopigment concentration reached a maximum in late October. No significant correlation was found between zooplankton abundance and pigment concentration indicating that zooplankton food chains are primary detrital in Lake Erie. (SM)

Good, E. E. - See: H. G. Smith, et al, No. 708.

287. Good, E. E. 1961. The original vegetation of Van Wert County, Ohio. Ohio J. Sci. 61(3):155-160.

This paper documents the information that is available concerning the nature and distribution of the original forests of Van Wert County, an area of 405 square miles in western Ohio drained by tributaries of the Maumee River, and notes changes in the remnants still present. (BU)

288. Goodrich, Calvin. 1911. _Lymnaea auricularia_ in Ohio. Nautilus. 25(1):11-12.

A brief note recording the discovery of _Radix auricularia_ L. on March 21, 1911 in a marshy stream less than 100 feet from Maumee Bay. _Bythinia tentaculata_ is the most common shell found in the mud flats of two marshy areas in that region. (SM)

289. Goodrich, Calvin. 1916. A trip to the islands in Lake Erie. Annals Carnegie Mus. Pittsburgh, Penn. 10(3-4):Article 20:527-531.

An account of a shell collecting trip to the Lake Erie islands in July of 1915. The party visited West Sister Island, Green Island and Mouse Island in Ohio; Middle Island, Middle Sister Island, North Harbor Island and East Sister Island in Ontario. (SM)

290. Goodrich, Calvin. 1920. Goniobasis of Ohio. **Nautilus.** 33(3):73-74.

A short article concerning distribution of Goniobasis livescens Monke and G. semicarinata Say within the borders of Ohio. G. livescens occurs in the Maumee River system, other tributaries of Lake Erie, and the shallows of Lake Erie. G. haldemanni was also found in the drifts of beaches along the lake. Other forms are found in the Ohio, Wabash and Muskingum systems. (SM)

291. Gotaas, Harold B. 1969. Outwitting the patient assassin: the human use of lake pollution. Bull. Atomic Scientists. (May). pp. 8-10.

A review of the problems of cultural eutrophication in freshwaterways, including Lake Erie. The author challenges some aspects of the emphasis on nutrient removal in current antipollution programs. He proposes alternate approaches such as seeding desirable fish species and re-establishing commercial fishing on the Great Lakes.

292. Gottschall, Russell Y. 1930. Preliminary report on the phytoplankton and pollution in Presque Isle Bay, Lake Erie. Proc. Penn. Acad. Sci. 4:69-74.

This article concerns the analysis of water samples taken from Presque Isle Bay during 1929. These samples were analyzed for their phytoplankton and bacteria content.

293. Gottschall, Russell Y. and O. E. Jennings. 1933. Limnological studies at Erie, Pennsylvania. Trans. Am. Micro. Soc. 52(3):181-191.

The report of a year-round survey of the phytoplankton and the chemical and physical conditions of the waters of Lake Erie in the vicinity of Erie, Pennsylvania. The work started in 1929 and was completed in June of 1931. At no time during

the two year study did the phytoplankton crop in the bay and lake fall below 25,000 plankton forms per liter. Diatoms were usually predominant. Near sewer outlets, phytoplankton was destroyed and fish were not present. (SM)

Graves, Robert C. - See: Brian E. Melin, No. 518.

294. Great Lakes Basin Commission. 1965. Comprehensive framework study (Type I) - plan of study. Great Lakes Basin Comm. Ann Arbor, Mich. 29 p.

A brief mention is made of the effects of eutrophication on the fish, birds and mammals of Lake Erie and its tributaries. Several species of fish are listed which either are decreased or have disappeared from these waters.

295. Great Lakes Basin Commission. 1969. Annual report for the year ending June 30, 1969. Great Lakes Basin Comm. Ann Arbor, Mich. 27 p.

A report on a comparative study of the coastlines of Lake Erie (a eutrophic lake with a dense coastline population) and Lake Superior (an oligotrophic lake with a sparse bordering population).

296. Great Lakes Basin Commission. 1969. Great Lakes Basin library interim bibliography II. Great Lakes Basin Comm. Ann Arbor, Mich. 440 p.

This annotated bibliography is a companion volume to the first interim bibliography issued in January of 1969. The same collection of documents and reports, as well as those received between January and April of that year, are listed. Lake Erie references are included.

297. Great Lakes Basin Commission. 1970. Annual report for the fiscal year ending June 30, 1970. Great Lakes Basin Comm. Ann Arbor, Mich. 27 p.

The annual report presents an overview of the Commission's major activities during the 1970 fiscal year. The Commission participated in the annual meeting of the Cleveland Section, American Society of Civil Engineers, in Cleveland in May 1970. The meeting program was on developments in water resources planning related to Lake Erie.

298. Great Lakes Basin Commission. 1971. Annual report for the fiscal year ending June 30, 1971. Great Lakes Basin Comm. Ann Arbor, Mich. 21 p.

The annual report reviews activities of the Commission for the year indicated. Included in the report is discussion of a proposed study of the Maumee River Basin.

299. Great Lakes Commission. 1966. Summary of state and provincial regulations relating to sport fishing on the Great Lakes. Great Lakes Comm. Ann Arbor, Mich. 15 p.

This summary of sport fishing regulations prepared by the Great Lakes Commission, is based on the 1965 digests of fishing laws published by each of the Great Lakes states and the Province of Ontario and has been reviewed by the agencies having control over fishing activities.

300. Great Lakes Commission. 1972. Report to the states 1971-1972. Great Lakes Comm. Ann Arbor, Mich. 53 p.

This report is a summary of the activities of the Commission during 1971-1972. The publication includes a report on commercial fishing in the Great Lakes. Lake Erie is reported to have provided 16% of the United States Great Lakes commercial catch and 82.8% of the Canadian Great Lakes commercial catch in the years 1966-70. In 1972, 13.6% of the United States total and 77.9% of the Canadian total Great Lakes commercial production came from Lake Erie.

301. Great Lakes Fishery Commission. 1967. Annual report for the year 1966. Great Lakes Fish. Comm. Ann Arbor, Mich. 61 p.

A review of fishery management and research on the Great Lakes. Emphasized is the decline of the walleye in Lake Erie. The cause of the year-class failures could not be determined from the evidence at hand, but two factors were suspected: (1) over exploitation; and (2) major changes in environmental conditions.

302. Great Lakes Fishery Commission. 1968. Annual report for the year 1967. Great Lakes Fish. Comm. Ann Arbor, Mich. 63 p.

A review of fishery management and research on the Great Lakes. The commercial fish landings in Lake Erie are summarized, listing the percentage of the total 1967 catch contributed by each of the Lake Erie states and Ontario. The dominant species for each state is also included.

303. Great Lakes Fishery Commission. 1970. Annual report for the year 1969. Great Lakes Fish. Comm. Ann Arbor, Mich. 58 p.

A review of fishery management and research on the Great Lakes. Included is a summary of the 1969 commercial catch in Lake Erie. The dominant species as well as the percentages of the total catch contributed by each of the bordering states and Ontario are listed. A marked reduction in the walleye production was noted and attributed to the restrictive regulations imposed on the walleye fishery in the Western Basin. Summarized also is the experimental planting program of coho salmon initiated by Ohio, Pennsylvania, and New York in an effort to determine the feasability of establishing a salmon sport fishery.

304. Great Lakes Institute. 1964. Great Lakes Institute data record - 1962 surveys. Part I: Lake Ontario and Lake Erie. Univ. Toronto. Great Lakes Inst. Toronto, Ont. Rept. PR 16. 97 p.

This report is a compilation of data collected in 1962 with the research vessel C.C.G.S. *Porte Dauphine* by the Great Lakes Institute. The data consists primarily of physical, chemical and meteorological parameters. The only biological data included is the number of plankton hauls (zooplankton) and fish finder records.

305. Great Lakes Institute. 1965. Annual report - 1964. Univ. Toronto. Great Lakes Inst. Toronto, Ont. Rept. PR 18. 47 p.

A review of the observations of 1964, which includes the number of plankton hauls, bottom samples (fauna) and fish finder records for Lake Erie, is given in tabular form. A brief summary of each of the Great Lakes Institute research programs conducted during 1964 is given. The following are those programs dealing with the biology of Lake Erie: (1) Great Lakes bottom fauna investigations; and (2) Great Lakes plankton investigations.

306. Great Lakes Institute. 1965. Great Lakes Institute data record - 1963 surveys. Part I: Lake Ontario, Lake Erie and Lake St. Clair. Univ. Toronto. Great Lakes Inst. Toronto, Ont. Rept. PR 23. 195 p.

This report is a compilation of data collected in 1963 with the research vessel C.C.G.S. *Porte Dauphine* by the Great Lakes

Institute. The data consists primarily of physical, chemical and meteorological parameters. The only biological data included is the number of plankton hauls (zooplankton), bottom samples (fauna) and fish finder records.

307. Great Lakes Institute. 1966. Annual report - 1965. Univ. Toronto. Great Lakes Inst. Toronto, Ont. Rept. PR 25. 55 p.

A review of the observations of 1965, which includes the number of plankton hauls, bottom samples (fauna) and fish finder records for Lake Erie, is given in tabular form. A brief summary of each of the Great Lakes Institute research programs conducted during 1965 is given. The following are those programs dealing with the biology of Lake Erie: (1) Bottom fauna of Lakes Ontario and Erie; (2) Studies on stream crayfishes - includes sampling sites from the Detroit River; (3) Great Lakes plankton investigations; and (4) Lake Erie phytoplankton investigations.

308. Great Lakes Institute. 1968. Annual report - 1967. Univ. Toronto. Great Lakes Inst. Toronto, Ont. Rept PR 31. 70 p.

A brief summary of each of the Great Lakes Institute research programs conducted during 1967 is given. The following deals with the biology of Lake Erie: studies on the benthos of the Great Lakes.

309. Great Lakes Institute. 1970. Annual report - 1969. Univ. Toronto. Great Lakes Inst. Toronto, Ont. Rept. PR 40. 42 p.

A review of the observations of 1969, which includes the number of plankton hauls for Lake Erie, is given in tabular form. A brief summary of each of the Great Lakes Institute research programs conducted during 1969 is given. The following deals with the biology of Lake Erie; studies on the phytoplankton in the Great Lakes.

310. Great Lakes Institute. 1971. Great Lakes Institute data record surveys in 1964 of the CCGS _Porte Dauphine_ for Lake Ontario, Lake Erie, Lake St. Clair, Lake Huron, Georgian Bay and Lake Superior. Univ. Toronto. Great Lakes Inst. Toronto, Ont. Rept. PR 42. 238 p.

This report is a compilation of data collected in 1964 with the research vessel C.C.G.S. _Porte Dauphine_ by the Great Lakes

Institute. The data consists primarily of physical, chemical and meteorological parameters. The only biological data included is the number of plankton hauls, bottom samples (fauna) and fish finder records.

311. Great Lakes Research Institute. 1971. The Lake Erie Congress: The proceedings of the first session, July 12-14, 1971, Erie, Pennsylvania. Great Lakes Res. Inst. Erie, Penn. 42 p.

This publication is a report of a general conference on the problems of Lake Erie. It was convened to allow interaction among varying interest groups. Objectives for the lake were adopted by the Congress and included preservation of a disease free water supply and production of fish. Recommendations include: (1) the establishment of regional laboratories to test water in order to protect public health and welfare; and (2) the establishment of research programs to monitor the response of life systems within the lake.

312. Great Lakes Research Institute. 1973. Selected analysis and monitoring of Lake Erie water quality annual report 1973. Erie County Health Dept. Erie, Penn. 60 p.

The Lake Erie Water Quality Study was undertaken to develop the information necessary for effectively planning the management of desired water quality in the region of Erie, Pennsylvania. The study began with the 1972 season which has been previously reported. Biological parameters included evaluation of coliform patterns, level of algae and zooplankton, and benthic macroinvertebrates. It was concluded that water samples collected in the Pennsylvania region of Lake Erie during the 1973 season shows very little difference in the water quality between points east and points west of Erie, Pennsylvania. The pollutant input level in the Erie area is apparently not sufficient to have any adverse effects on the water quality of Lake Erie.

313. Great Lakes Water Quality Agreement. 1972. Agreement between the United States of America and Canada on Great Lakes water quality. Ottawa, Ont. 67 p.

An international agreement with the stated purpose of restoration and enhancement of the water quality of the Great Lakes. Among the objectives adopted was that these waters should be free from substances resulting from human activity which adversely affect aquatic life or waterfowl, or create excessive growths of aquatic weeds and algae.

314. Great Lakes Water Quality Board. 1973. Great Lakes water quality annual report to the International Joint Commission. Great Lakes Water Quality Bd. Chicago, Ill. 315 p.

This report presents a current assessment of water quality in the boundary waters of the Great Lakes, and of the control programs and other measures set forth in the Great Lakes Water Quality Agreement of 1970. The most significant lakewide problem in Lake Erie is eutrophication due mainly to cultural over-enrichment by nutrients. A major symptom of eutrophication is the depletion of hypolimnetic dissolved oxygen in the Central and Eastern Basins in late summer. There are, however, significant near-shore areas which are strongly influenced by waste discharges from point sources and tributaries, particularly along the southern shore. The report details the regulations of Great Lakes states and Ontario and specifies cases of non-compliance with these regulations.

315. Greeley, John R. 1929. Fishes of the Erie-Niagara watershed. In: A Biological Survey of the Erie-Niagara System. N.Y. Dept. Cons. Albany, N.Y. Suppl. 18th Ann. Rept. (1928). pp. 150-179.

A survey of the fishes of Lake Erie regarding distribution and habits of various species, conditions of their environment, relative abundance, and relative economic importance.

316. Greeley, John R. 1933. The growth rate of rainbow trout from some Michigan waters. Trans. Am. Fish. Soc. 63:361-378.

Ages of 329 rainbow trout from Michigan streams and lakes were determined by scale analysis. Data was used to comment on migratory habits, scale characteristics, growth types, age-size relationships, age at maturity, longevity, and growth rate in relation to angling value. Two of the specimens were collected from Lake Erie. (CCIW)

317. Greeley, John R. 1956. The lamprey in New York waters. N.Y. State Dept. Env. Cons. Albany, N.Y. Conservationist. 11(1):18-22.

A report on the six species of lampreys found in New York. Four of the six are non-parasitic. The parasitic Ichthyomyzon concdor is thought to be responsible for some scars on Lake Erie fish. The parasitic sea lamprey, Petromyzon marinus is the largest and most numerous. The first specimen was recorded

in Lake Erie in 1921. Since Lake Erie has never produced lake trout in any large quantity, but instead produces a wide variety of species, the effect of the sea lamprey has not been as pronounced there as in the upper Great Lakes. There is also a lack of suitable spawning streams for sea lamprey on Lake Erie. (SM)

318. Greeley, John R. 1961-1962. Our stake in the Great Lakes fisheries. N.Y. State Dept. Env. Cons. Albany, N.Y. Conservationist. 16(3):14-15.

A comparison of the Lake Erie and Lake Ontario fisheries of New York State as well as a discussion of their management and values. The increasing importance of bass fishing and smelt production in Lake Erie is discussed as well as the decline of blue pike, whitefish, yellow pike and cisco. (SM)

319. Grier, N. M. 1918. New varieties of naiades from Lake Erie. Nautilus. 32(1):9-12.

Three new varieties of naiades collected at Presque Isle, Pennsylvania are carefully described and measurements given. It is suggested that these forms are generally distributed throughout the lake. They include Elliptio dilatatus var. sterkii, Lasmigona costata var. eriganensis, and Fusconaia flava var. parvula. (SM)

320. Grier, N. M. 1920. On the erosion and thickness of shells of the freshwater mussels. Nautilus. 34(1):15-22.

This report brings together information on shell thickness of mussels from the upper Ohio drainage and Lake Erie. Lake Erie shells are comparatively less eroded, shorter, and have a greater relative degree of inflation. Some species also possess characteristics indicating a depauperate type of growth. In all species from Lake Erie it appears that the thickness of the shell is negatively correlated with the percentage of calcium carbonate in the water. (SM)

321. Grier, N. M. 1920. Variations in epidermal color of certain species of naiades inhabiting the Upper Ohio drainage and their corresponding ones in Lake Erie. Am. Mid. Nat. 6(12):247-285.

An extensive analysis of the epidermal color of certain species of freshwater mussels of Lake Erie and the upper Ohio drainage. The author attempts to determine the prevalent color of each species, the effect of the body of water on the color, and the relationships between age and color and sex and color. (BU)

322. Grier, N. M. 1920. Variations in nacreous color of certain species of naiades inhabiting the Upper Ohio drainage and their corresponding ones in Lake Erie. Am. Mid. Nat. 6(10):211-243.

An extensive analysis of the nacreous color of certain species of freshwater mussels of Lake Erie and the upper Ohio drainage. The author attempts to determine the prevalent color of each species, the effect of the body of water on the color, and the relationship between sex and color. (BU)

323. Grier, N. M. 1922. Observations on the rate of growth of the shell of lake dwelling fresh water mussels. Am. Mid. Nat. 8(6):129-148.

The external morphological characteristics of the shells of various species of mussels collected from Lake Erie between 1903 to 1907 were studied. Data is presented for each of the 12 species studied. This data is used to estimate the rate of growth of the shells. Comparisons of the rates of growth between the species and between the various parts of each shell are made. (BU)

324. Griggs, Robert F. 1901. Additions to the Sandusky flora. Ohio Nat. 1(6):97-98.

Contains a list of plants found in the Sandusky area not listed in Professor Moseley's "Sandusky Flora". The purpose of the present article is to update Professor Moseley's work. (BU)

325. Griggs, Robert F. 1901. Notes on the bird life of Cedar Point. Ohio Nat. 1(6):91-93.

Contains a list of the summer avifauna residents inhabiting Cedar Point. (BU)

326. Guire, Kenneth E. and Edward G. Voss. 1963. Distribution of distinctive shoreline plants in the Great Lakes region. Mich. Bot. Ann Arbor, Mich. 2(4):99-114.

A report on distribution of vascular shoreline plants in the Great Lakes region. Maps are presented which show the territorial distribution of each species. (SM)

327. Gunn, William W. H. 1948. Reverse migration over Lake Erie. Wilson Bull. 60(1):67.

The summary of a report presented at the 29th annual meeting of the Wilson Ornithological Club in November of 1947. The presentation was illustrated with slides and described the spring migration of at least 60 species of birds from Pelee Island, Pelee Point and Fishing Point to the south. (SM)

328. Gunn, William W. H. 1963. Bird finding in Ontario. Part 1. Can. Audubon Soc. Toronto, Ont. Can. Audubon. 25(5):159-167.

This article describes areas of Ontario that are of particular interest to the bird watcher. Lake Erie counties are outstanding bird sites. Viewing areas are described along the northern shore of the lake. Point Pelee is particularly good. It is possible to see as many as 100 species there in a single day in May. (SM)

329. Gunn, William W. H. 1964. Bird finding in Ontario. Part 2. Can. Audubon Soc. Toronto, Ont. Can. Audubon. 26(1):18-24.

This article describes areas of Ontario that are attractive to warblers. Thirty-three species of warblers are known to breed in the province. A list of favorable locations and dates for finding 120 Ontario bird species is included. (SM)

Gutenmann, Walter H. - See: Raymond J. Lovett, et al, No. 489.

330. Hall, Ada R. 1925. Effects of oxygen and carbon dioxide on the development of the whitefish. Ecology. 6(2):104-116.

A report on an experiment designed to find out the relative sensitivity of the stages in the early life history of the whitefish and to test the resistence and reactions of normally hatched individuals as compared with the reactions of those hatched under experimental conditions. The fish eggs were obtained from a hatchery at Put-in-Bay, Ohio and the water for the normal hatching was taken from Lake Erie. (BU)

Hamilton, A. L. - See: R. O. Brinkhurst, et al, No. 88.

331. **Harkness, W. J. K.** 1922. The rate of growth of the yellow perch (Perca flavescens) in Lake Erie. Ont. Fish. Res. Lab. Pub. 6. pp. 89-95.

A brief analysis of the rate of growth of the yellow perch of Lake Erie. Samples were collected at Merlin, Ontario in 1920. Age was determined and morphological measurements were taken. (CCIW)

332. Harlow, George L. 1966. Major sources of nutrients for algal growth in Western Lake Erie. Univ. Mich. Great Lakes Res. Div. Proc. 9th Conf. on Great Lakes Res. Pub. 15:389-394.

Due to an excess of nutrients, Western Lake Erie has developed prolific blooms of algae contributing to and indicating the accelerated enrichment of this valuable natural resource. This paper presents the increases in nutrient concentrations and quantities from the waters of Lake St. Clair to Western Lake Erie as the waters pass by the metropolitan complex of Detroit. The sources of waste which contribute to these increases are presented as well as the relative quantities from each waste source.

Harris, C. R. - See: J. R. W. Miles, No. 531.

Harris, Earl J. - See: Irene S. Pakkala, et al, No. 619, 620, Raymond J. Lovett, No. 489.

333. Hart, J. S. 1952. Geographic variations of some physiological and morphological characters in certain freshwater fish. Ont. Fish. Res. Lab. Pub. 72. 79 p.

A study of the geographic variation of lethal temperatures and diagnostic morphological characteristics in ten species of freshwater fish. Samples were taken from Put-in-Bay and Sandusky Bay, Ohio, as well as waters in Tennessee and Florida. Comparisons between species and areas are made. (CCIW)

Hartman, Wilbur L. - See: H. A. Regier, No. 653.

334. Hartman, Wilbur L. 1970. Resource crises in Lake Erie. Explorer. 12(1):6-11.

The effect of accelerated enrichment, unabated pollution, over-exploitation, and accidental and intentional introduction of exotic species on Lake Erie's fish populations.

335. Hartman, Wilbur L. 1972. Lake Erie: effects of exploitation, environmental changes and new species on the fishery resources. J. Fish. Res. Bd. Can. 29(6):899-912.

In no other lake as large as Lake Erie (surface area, 25,690 km^2) have such extensive changes taken place in the drainage basin, the lake environment, and the fish populations over the last 100 years. Deforestation and prairie burning led to erosion and siltation of valuable spawning grounds. Marsh spawning areas were drained. Lake-to-river spawning migrations were blocked by mill dams. Accelerated cultural nutrient loading increased total dissolved solids by nearly 50% (1920-1970). Average summer water temperatures increased 1.1°C. Phytoplankton and zooplankton abundance increased severalfold. Severe oxygen depletion developed in the bottom waters of all three basins of the lake. Lake sturgeon were fished out as a nuisance fish in the late 1800's. The commercial fisheries for lake trout, lake whitefish, and lake herring collapsed by 1940 and those for blue pike and walleye by 1960. Yellow perch production became unstable in the 1960's. The effects of exploitation, environmental changes, and new species on these fish population changes are discussed. (SM)

336. Hartman, Wilbur L. 1973. Effects of exploitation, environmental changes, and new species on the fish habitats and resources of Lake Erie. Great Lakes Fish. Comm. Ann Arbor, Mich. Tech. Rept. 22. 43 p.

No other lake as large as Lake Erie (surface area, 25,690 km^2) has been subjected to such extensive changes in the drainage basin, the lake environment, and the fish populations over the past 150 years. Siltation of spawning grounds as a result of deforestation and prairie burning, drainage of marsh spawning areas, blockage of lake-to-river migrations by mill dams, accelerated cultural nutrient loading resulting in an increase in dissolved solids, and oxygen depletion led to the disappearance or severe depletion of fish species. The sequence of disappearance or depletion was as follows: lake trout, sturgeon, lake herring, lake whitefish, sauger, blue pike, and walleye. Yellow perch are now declining. The cultural stresses, in the probable order of greatest to least net effects on the fish community of Lake Erie, appear to have

been: (1) an intense, opportunistic, ineffectively controlled commercial fishery; (2) changes in the watershed, such as erosion and siltation of stream beds and inshore lake areas, and construction of dams in tributaries; (3) nutrient loading, destruction of biota, and reduction of dissolved oxygen; and (4) the competitive predatory activities of invading species.

337. Hartund, Rolf and Gwendolyn W. Kingler. 1970. Concentration of DDT by sedimented polluting oils. Env. Sci. Tech. 4(5):407-410.

Significant amounts of polluting oils settle out in rivers and lakes after oil pollution incidents. This study investigates the relationship between oils and DDT in sediments from the Detroit River. It is suggested that the biological implications of the concentrating behavior of these oils should be investigated. (BECPL)

338. Hasler, Arthur D. and Bruce Ingersoll. 1968. Dwindling lakes. Nat. History. 77(9):8-31.

A general discussion of cultural eutrophication of the American freshwater lakes and how blue-green algae cause the natural aging and disappearance of lakes. Lake Erie pollution is mentioned as the phenomenon that brought the problem of water pollution to the public eye.

339. Hasler, Arthur D. and Marlette E. Swenson. 1967. Eutrophication. Science. 158(3798):278-282.

A report on an international symposium on eutrophication held at the University of Wisconsin, June 11-16, 1967. Lake Erie was one of several eutrophic lakes discussed. The ideas presented by various participants are summarized. (SM)

340. Hatcher, Harlan. 1944. The Great Lakes. Oxford Univ. Press. New York, N.Y. 384 p.

A historical account of the Great Lakes region with discussion of geological formation, exploration, territorial disputes, and commerce. Illustrations and maps are included. Discussions of the fishing industry and other material concerning Lake Erie and its shoreline are dispersed throughout this literature. (SM)

341. Hatcher, Harlan. 1945. Lake Erie. Bobbs Merrill Co. Indianapolis, Indiana. 416 p.

A comprehensive review of the history of Lake Erie from the time of the first explorations through the periods of settlement and industrial development. Social and economic influences including shipping, wars, and the fishing industry are given consideration. Agricultural development of the shoreline and islands is also described. (SM)

342. Hatcher, Harlan. 1968. Lake Erie. Encyclopedia Americana. Internat. Ed. 10:477-478.

A general article on the history of Lake Erie. There is comment on the industrial and agricultural use of the Lake Erie shoreline and islands. (SM)

343. Hayes, F. R. and E. H. Anthony. 1964. Production capacity of North American lakes as related to the quantity and trophic level of fish, the lake dimensions, and the water chemistry. Trans. Am. Fish. Soc. 93(1):53-57.

In an attempt to clarify interrelationships of physical and biological factors in lakes and to provide a method for predicting fish production, a series of regressions between the Productivity Index and the independent variables of area, depth and alkalinity were computed and tested for significance. Lake Erie is mentioned as having deviated the most among the Great Lakes from its calculated Productivity Index. (BU)

Health, Ralph C. - See: Robert D. MacNish, et al, No. 4[illegible]8.

344. Hedrick, L. R., Marjorie Soyugenc, P. DuPont and R. Ambrosini. 1964. Yeasts in Lake Michigan and Lake Erie. Univ. Mich. Great Lakes Res. Div. Proc. 7th Conf. on Great Lakes Res. Pub. 11:77-83.

A comparative analysis of the yeasts of Lakes Michigan and Erie. In Lake Erie the density of yeasts per unit volume was less than in Lake Michigan but the variety of yeasts is larger. The number of species of <u>Rhodotorula</u> was greater and several species of <u>Trichosporon</u> were found; members of this genus were seldom encountered in waters from Lake Michigan, except in samples of mud or the waters near the bottom. Data concerning yeasts from the Atlantic and Pacific Oceans is also compared to that of the Great Lakes.

Henry, Norma Scott - See: Jessie Finley Klocke, et al, No. 433.
Jessie Finley Klocke, et al, No. 434.

345. Henson, E. Bennette. 1966. A review of Great Lakes benthos research. Univ. Mich. Great Lakes Res. Div. Pub. 14:37-54.

Research attention to the earth-water interface and to the associated plant and animal populations inhabiting the bottom substrata of the Great Lakes has recently both gained in intensity and changed in emphasis. An objective of this article is to focus attention to Great Lakes benthos research that serves as an oar in the movement of future limnological understanding. An effort is made here to contribute to unified knowledge of Great Lakes benthos by adopting one vantage point and bringing out salient historic aspects, summarizing present investigations, evaluating benthos composition, and refocusing this in terms of temporal dynamics. The selected vantage point will consider the benthos as an entity in geologic time subject to the eutrophic forces of biological succession.

346. Herbst, Richard P. 1969. Ecological factors and the distribution of Cladophora glomerata in the Great Lakes. Am. Mid. Nat. 82(1):90-98.

Nutrient enrichment in the Great Lakes has provided fertile areas for growth of algal nuisances. One of these species, Cladophora glomerata, has become a major problem for many cities bordering the Great Lakes. Ecological factors concerning its growth in Milwaukee's harbor were studied, and its distribution in the Great Lakes determined. Phosphorus levels appear to be closely linked with Cladophora increases. (SM)

347. Herdendorf, Charles E. 1970. Lake Erie physical limnology cruise, midsummer 1967. Ohio Dept. Nat. Resources. Div. Geol. Surv. Columbus, Ohio. Rept. Invest. 79. 77 p.

This report provides information on the physical limnology of Lake Erie, with particular attention to circulation patterns and to changes in the quality of the water as it passes through the lake. The objective of the field survey was to measure several physico-chemical properties of Lake Erie water from its major inflow at the Detroit River to outflow in the Niagara River. Station data sheets also show the presence of algae turbidity, Aphanizomenon, in Western Lake Erie, and plankton turbidity, Daphnia, in Central Lake Erie.

348. Herdendorf, Charles E. and Lawrence L. Braidech. 1972. Physical characteristics of the reef area of Western Lake Erie. Ohio Dept. Nat. Resources. Columbus, Ohio. Rept. Invest. 82. 90 p.

A three-year study was made to determine the physical characteristics of the reefs and surrounding areas in Western Lake Erie. The investigation was undertaken to provide State and Federal fisheries biologists with information in support of their resource management programs, particularly as the physical makeup of the area relates to the spawning, nursery, and feeding grounds for such species as walleye (*Stizostedion vitreum vitreum*), white bass (*Roccus chrysops*), and channel catfish (*Ictalurus punctatus*). The project extended from April 1, 1967 to March 31, 1970.

Heritage, Albert C. - See: Bernard S. Meyer, No. 525.

349. Herms, William B. 1907. Notes on a Sandusky Bay shrimp, *Palaemonetes exilipes* Stimpson. Ohio Nat. 7(4):73-79.

During the summer of 1904 several specimens of *Palaemonetes* were collected from Sandusky Bay. The habitat is described and several experiments concerning the effect of light on the shrimp are presented. (BU)

350. Herrick, J. Arthur. 1936. Two new species of *Myxobolus* from fishes of Lake Erie. Trans Am. Micro. Soc. 55(2):194-198.

Descriptions of two new species of Myxosporidia found in several fish collected from the island region of Western Lake Erie. (BU)

351. Herrick, J. Arthur. 1941. Some myxosporidian parasites of Lake Erie fishes. Trans. Am. Micro. Soc. 60(2):163-170.

An examination of 24 specimens of *Eupomotis gibbosus* Linnaeus (pumpkinseed), collected in Western Lake Erie during the summers of 1933 and 1934, revealed five gall bladder infections of *Chloromyxum gibbosum* sp. nov. One of these fish was infected with *Myxobolus gibbosus* sp. nov. which produced small cysts on the gill arches. The urinary bladders of 7 of the fish were found to be infected with *Henneguya ohioensis* sp. nov. During the same period 27 of 30 specimens of *Ambloplites rupestris* Rafinesque, collected in the same waters, had

urinary bladder infection with *Henneguya rupestris* sp. nov. The four new species are described in detail.

Herrington, H. B. - See: R. O. Brinkhurst, et al, No. 68.

Hetling, Leo J. - See: Patricia Boulton, No. 80.

352. Higgins, Elmer. 1928. Conference of Lake Erie biologists. Science. 67(1734):309-310.

A report on a meeting at Cleveland on February 6, 1928, of representatives of Federal, State, and Provincial research agencies and of scientific and educational institutions to formulate and coordinate plans for limnological and fishery investigations of Lake Erie. (SM)

353. Higgins, Elmer. 1928. Cooperative fishery investigations in Lake Erie. Sci. Mon. 27:301-306.

A review of the principles and an examination of the field of study of numerous research projects presented at a conference of biologists called by the U.S. Commissioner of Fisheries on February 6, 1928 at Cleveland, Ohio.

354. Higgins, Elmer. 1938. Fish outlive officials. State Govt. 11(3):53-54, 58.

A summary of arguments in support of the belief that overfishing caused the depletion of Great Lakes fisheries. Past failures to attain adequate regulations through voluntary cooperation of State and Provincial agencies, and recommendations for establishment of central control by means of an international treaty are reviewed. (BU)

Hile, Ralph - See: John Van Oosten, No. 826.

355. Hile, Ralph. 1962. Collection and analysis of commercial fishing statistics in the Great Lakes. Univ. Mich. Great Lakes Fish. Comm. Ann Arbor, Mich. Tech. Rept. 5. 31 p.

The purpose of this paper is to review the origin and development of the statistical system used in the collection and analysis of commercial fishery statistics, to explain the logic that underlies the analytical procedure, and to comment on various areas of weakness and strength.

Although this paper is concerned only with the collection and analysis of catch-effort data for major species, the tabulations include the recording of the take of all species. Therefore, they supply a full record of commercial production.

356. Hile, Ralph. 1966. U.S. federal research on fisheries and limnology in the Great Lakes through 1964: an annotated bibliography. U.S. Dept. Interior. Bur. Commercial Fish. Spec. Sci. Rept. - Fish. 528. 53 p.

The annotated bibliography is preceded by a brief account of the Federal research program in fisheries and limnology in the Great Lakes in 1957-64. The bibliography covers 314 papers by staff members of the Bureau of Commercial Fisheries Biological Laboratory in Ann Arbor, Michigan, and 35 by associated scientists with whom the Laboratory had contractual or other cooperative arrangements; included also are patents issued to Laboratory personnel. A roster of Laboratory scientists as of December 31, 1964 is appended.

357. Hill, Gladwin. 1965. The Great and dirty lakes. Saturday Rev. 48:32-34.

A general discussion of pollution in the Great Lakes with an emphasis on Lake Erie. Reference is made to both industrial and municipal wastes and the extent of their entry into the lakes.

Hiltunen, Jarl K. - See: David R. Wolfert, No. 8?4.

358. Hiltunen, Jarl K. 1965. Distribution and abundance of the polychaete, Manayunkia speciosa Leidy, in Western Lake Erie. Ohio J. Sci. 65(4):183-185.

The abundance and distribution of the freshwater polychaete, Manayunkia speciosa, in 1961, is described for Western Lake Erie. Previous records reveal that the species has either been generally overlooked or presently its numbers have greatly increased in the area considered.

359. Hiltunen, Jarl K. 1966. Moss from the bottom of the Great Lakes. Mich. Bot. Ann Arbor, Mich. 5(2):62-63.

A short article describing the discovery of the moss, Fissidens debilis Schwaegr, growing on a submerged clay surface in

Lake Erie. Specimens of Fissidens have also been found in Lakes Michigan, Superior and Ontario. (SM)

360. Hiltunen, Jarl K. 1969. Distribution of oligochaetes in Western Lake Erie, 1961. Limnology and Oceanography. 14(2):260-264.

A total of 52,390 oligochaetes were collected from 40 stations in Western Lake Erie in spring 1961. The population was composed of two families, Naididae and Tubificidae. Only six species of naidids were found. One, Paranais frici, is apparently new to the list of North American freshwater Naididae. Among the 14 tubificids found, five species of Limnodrilus were most abundant; they contributed 90% or more of all oligochaetes at 33 of the 40 stations. Numbers of Limnodrilus were generally large near the mouths of the Detroit, Raisin and Maumee rivers and decreased progressively lakeward. Stylodrilus heringianus, a pollution-intolerant species common in Eastern Lake Erie, was not found in the western end of the lake.

361. Hine, James S. 1901. Dragonflies of Sandusky. Ohio Nat. 1(6):94-95.

Contains a list with accompanying notes of the dragonfly species inhabiting the Sandusky marshes. (BU)

362. Hintz, Walter James. 1955. Variations in populations and cell dimensions of phytoplankton in the island region of Western Lake Erie. Ohio J. Sci. 55(5): 271-278.

During the fall of 1952 and the winter of 1953, water samples were taken around the island area of Western Lake Erie in order to determine the phytoplankton populations in that region. In the fall of 1953 and the winter of 1954 samples were taken at a single station to supplement the data of the previous year. Three-dimensional measurements of each species were made, and the populations were calculated in volumetric units. (BU)

363. Hoffman, R. D. and R. D. Curnow. 1973. Toxic heavy metals in Lake Erie herons. Internat. Assoc. Great Lakes Res. Proc. 16th Conf. on Great Lakes Res. pp. 50-53.

Great blue herons (Ardea herodias), black-crowned night herons

(Nycticorax nycticorax) and American egrets (Casmerodius albus) of the southwestern Lake Erie region were collected and assayed for toxic metals concentrations. During August and September 1972, eleven great blue herons, eight black-crowned night herons and six American egrets were collected from island and mainland heronries and marshlands in the Oak Harbor-Port Clinton, Ohio vicinity. Tissue samples from adult, juvenile and nestling birds included breast muscle, brain and liver. Primary wing feathers were also collected from adult and juvenile birds. Concentrations of mercury, cadmium and lead were determined by atomic absorption spectrophotometry. Mercury concentration levels differed between bird species, location of collection, and age.

364. Hohn, Matthew H. 1966. Analysis of plankton ingested by Stizostedion vitreum vitreum (Mitchell) fry and concurrent vertical plankton tows from south-western Lake Erie, May 1961 and May 1962. Ohio J. Sci. 66(2):193-197.

The analysis of plankton tows for May 1961 and May 1962 showed four species of diatoms, Melosira binderana, M. ambigua, Fragilaria capucina and F. crotonensis to be dominant. The analysis of the intestinal tract of the walleye fry showed these four species to be dominant in the fry up to 9 mm. Those fry above 9 mm contained zooplankton as well as species of these diatoms. This preliminary study indicates a change in food habits of the walleye fry at the 9-mm stage.

365. Hohn, Matthew H. 1969. Qualitative and quantitative analyses of plankton diatoms - Bass Island area, Lake Erie, 1938-1965 including synoptic surveys of 1960-1963. Bull. Ohio Biol. Surv. New Ser. 3(1):211 p.

A report on a quantitative and qualitative analysis of the plankton diatom flora collected from the Bass Islands area of Western Lake Erie. The results show a definite pattern in regards to species complex, occurrence, and percent occurrence of the major species and occurrence and volume of the total population.

366. Hosford, Karl R. 1971. Environmental laws and their effect on planning. In: Planning for Lake Erie's Future. Conference sponsored by the Chair in Aquatic Ecology at John Carroll University, Cleveland, Ohio. Pamphlet. Unnumbered.

An edited version of a paper delivered at the conference held on November 3, 1971. Among the environmental regulations discussed are a fishery zone management plan which designates three principal types of water areas; sport fishing development zones; rehabilitation zones; and commercial fishing zones with a program to rehabilitate the Great Lakes Fishery. The laws discussed are those of the State of Michigan.

House, Robert - See: Larue Wells, No. 856.

367. Howard, David L., James I. Frea, Robert M. Pfister and Patrick R. Dugan. 1970. Biological nitrogen fixation in Lake Erie. Science. 169:61-62.

Biological nitrogen fixation, as determined by acetylene reduction, occurs in Lake Erie. Fixation potential by blue-green algae in situ in water and by bacteria in collected sediments was demonstrated. Nitrogen-fixing activity occurred from June through November suggesting that it is significant over the extremes of seasonal variation in light, temperature, and nutrients.

368. Howard, David L., James I. Frea and Robert M. Pfister. 1971. The potential for methane-carbon cycling in Lake Erie. Internat. Assoc. Great Lakes Res. Proc. 14th Conf. on Great Lakes Res. pp. 236-240.

Biological methane production and oxidation were studied by in situ methods in the Western Basin of Lake Erie and in the laboratory by isolated cultures obtained from the lake. Two gram negative bacillae capable of producing methane in simple salts medium were isolated several times during the summer months of 1970. Two methane oxidizing bacteria were also isolated from the lowest meter of the water column and from the surface of sediments, but no methane oxidation or isolates could be obtained from areas devoid of sediments.

369. Howell, H. D. 1972. The development of a bulk handling technique for smelt on Lake Erie. Ont. Ministry Nat. Resources. Div. Fish and Wildlife. Commercial Fish and Fur Branch. Toronto, Ont. 11 p.

Comparison is made between the old technique of loading smelt into small boxes and the new bulk handling technique. Merits of the latter are discussed.

370. Howell, H. D. 1972. The development of a fish meal plant. Ont. Ministry Nat. Resources. Div. Fish and Wildlife. Commercial Fish and Fur Branch. Toronto, Ont. 15 p.

Prior to 1955, most of the fish taken in Lake Erie were large, high-valued species which required little or no processing before shipment to markets. Since that time, increasing quantities of smaller, lower-valued species have been taken which require processing to increase sales. The wastes (heads, bones, and intestines) presented a disposal problem. This article discussed the development of a fish meal plant for processing these lower-valued species and waste products.

371. Hubbs, Carl L. 1921. An ecological study of the life history of the fresh-water atherine fish *Labidesthes sicculus*. Ecology. 2(4):262-276.

This paper deals with *Labidesthes sicculus*, a fresh water fish collected and observed in the waters of Southeastern Michigan. Diurnal, seasonal and age changes in its habits and in habit reaction as well as the varied effects of the environment on its rate of growth and the main features of its life history are discussed. (BU)

372. Hubbs, Carl L. and Karl F. Lagler. 1941. Guide to the fishes of the Great Lakes and tributary waters. Cranbrook Inst. Sci. Bloomfield Hills, Mich. Bull. 18. 100 p.

A manual which attempts to provide a means by which interested persons may: (1) learn the characteristics of importance for the identification of freshwater fishes and the methods by which they may be accurately distinguished; (2) "key" the Great Lakes species to their correct taxonomic designation; (3) become acquainted with their known geographic range; and (4) find an ecological annotation indicating the habitat in which each form most frequently lives. Line drawings and photographs along with directions for counting and measuring are also included. (SM)

373. Hubbs, Carl L. and Karl F. Lagler. 1947. Fishes of the Great Lakes region. Cranbrook Inst. Sci. Bloomfield Hills, Mich. Bull. 26. 186 p.

A reference which provides characteristics of importance for the identification of freshwater fishes and the means by which

they may be accurately distinguished and keyed to their correct names. The known geographic ranges, natural history information for each family, and an ecological annotation for each species is provided. Information on methods of collecting and preserving fish is also included. (SM)

374. Hubbs, Carl L. and Karl F. Lagler. 1958. Fishes of the Great Lakes region. Cranbrook Inst. Sci. Bloomfield Hills, Mich. Bull. 26. Revised ed. 213 p.

A reference which provides characteristics of importance for the identification of freshwater fishes and the means by which they may be accurately distinguished and keyed to their correct names. The known geographic ranges, natural history information for each family and an ecological annotation for each species is provided. Information on methods of collecting and preserving fish is also included. (SM)

375. Hubbs, Carl L. and Karl F. Lagler. 1970. Fishes of the Great Lakes Region. Univ. Mich. Press. Ann Arbor, Mich. 213 p.

This book contains an extensive account of the fish fauna of the Great Lakes region. Included is a discussion of the waters of the Great Lakes and their fish associations followed by sections on zoogeography, postglacial dispersion, field study and collecting fishes, and preservation of fishes for study. Twenty-nine families of fishes are represented in the Great Lakes basin. For each of these families, there is an account of the recognizable characteristics, a statement of geographical distribution, and knowledge regarding habits and relations to man. Also included is a key for the identification of the species and subspecies recognized for the region followed by a word-sketch of the range of each.

376. Hubbs, Carl L. and T. E. B. Pope. 1937. The spread of the sea lamprey through the Great Lakes. Trans. Am. Fish. Soc. 66:172-176.

A review of the historical background on the spread of the sea lamprey through the Great Lakes. Included is a brief description of the morphological characteristics of this parasite as well as its effect on fish. (CCIW)

377. Hubschman, Jerry H. 1971. Lake Erie: pollution abatement, then what? Science. 171:536-540.

The article presents another possible solution to eutrophication in Lake Erie. Pollution abatement can only solve the problem to a limited extent. The author suggests the possibility of introducing selected species of benthic macrofauna which could help establish a system that would be ecologically as well as economically desirable.

378. Hubschman, Jerry H. and W. J. Kishler. 1972. Craspedacusta sowerbyi Lankester 1880 and Cordylophora lacustris Allman 1871, in Western Lake Erie (Coelenterata). Ohio J. Sci. 72(6):318-321.

Thirty-seven stations, representing a variety of rocky habitats in the Lake Erie island region were sampled over a three-year period. Rock samples were hand-picked by diving and identification made from living material. The colonial hydroid Cordylophora lacustris was collected at fourteen widely separated locations. The minute polyp form of the freshwater jellyfish Craspedacusta sowerbyi was collected at all of the stations sampled. New hydranth buds, frustules, and medusoid buds were produced in the laboratory by the polyps collected.

379. Hufford, Terry L. 1965. A comparison of photosynthetic yields in the Maumee River, Steidtmann's Pond, and Urschel's Quarry under natural conditions. Ohio J. Sci. 65(4):176-183.

A study of photosynthetic rates under natural conditions in the Maumee River, Steidtmann's Pond, and Urschel's Quarry, computed from pH and O_2 measurements in the natural habitat at 4- to 6-hr intervals, revealed average rates of 1.4 to 20.9 μmol CO_2 absorbed per liter of water per hour, and 0.27 to 1.32 μmol CO_2 absorbed per μliter of plant matter per hour, with 0.1 to 35.0 μmol O_2 evolved per liter of water per hour, and about 0.012 to 2.22 μmol O_2 evolved per μliter of plant matter per hour. These values lie within the range of values for ponds, quarries, lakes, and streams reported in the literature. They are much lower than published values for clear flowing streams. It seems likely that poor light supplies resulting from suspended silt particles cancel any ecological advantage the turbulence of flowing water might provide. The ratios of O_2 production to CO_2 absorption were close to unity except during the spring flood period when ratios below 0.1 were observed, similar to ratios found in a shallow pond near Bowling Green.

Hunt, George S. - See: Dennis R. King, No. 428.

380. Hunt, George S. 1960. Lead poisoning among ducks wintering on the lower Detroit River. In: James B. Trefethen (Ed.), Transactions of the Twenty-Fifth North American Wildlife and Natural Resources Conference. March 7, 8, and 9, 1960. Dallas, Texas. Wildlife Manage. Inst. Washington, D.C. pp. 162-170.

Since 1930 large numbers of ducks have wintered on the Detroit River. The study extended from 1948-1955 during which 14,391 ducks were examined for ingested lead shot. The incidence of ingested lead shot differed little between ducks which were live-trapped, those found dead, and those shot and examined. It was concluded that lead poisoning was a minor cause of mortality. (SM)

381. Hunt, George S. 1961. Waterfowl losses on the lower Detroit River due to oil pollution. Univ. Mich. Great Lakes Res. Div. Proc. 4th Conf. on Great Lakes Res. Pub. 7:10-26.

The causes of duck mortality were investigated from 1948 to 1956 on the lower Detroit River during which oil pollution was found to be among the factors which caused the demise of waterfowl in the area studied. Ducks were live-trapped and banded in order to obtain information regarding their health, and in order to assess changes in their condition when they were later recovered or retrapped. All ducks which were found dead in the area studied were retrieved in order to determine the cause of death. More than 2,000 dead ducks were examined in the field and 134 were necropsied in the laboratory. Oils, both natural and pollutant types, were extracted from the feathers of a number of dead ducks in order to learn how much oil was present, its viscosity, and whether additives were present.

Eleven experiments were conducted to test the effects on living ducks of externally applied oils, and two to determine the effects of ingested oils. Cloacal temperatures of 37 lesser scaups were taken in order to assess the effect of oil on body heat loss. Data were compiled regarding the frequency of oil flows in the area. The effects of oil on ducks confined in live-traps in the Detroit River and in an outdoor pen at Lansing were studied.

382. Hunt, George S. 1962. Seasonal aspects of Berchtold's pondweed. Mich. Bot. Ann Arbor, Mich. 1(1):35.

A summary of observations of the Berchtold's pondweed, Potamogeton berchtold, made during 1953, 1954, and 1955 on the lower Detroit River. Spectacular seasonal changes in abundance were noted. During each year this aquatic plant was abundant during early July. By July 15 it began to disintegrate and float off in large masses. By the end of July it had been replaced by wild celery and other aquatic plants. (SM)

383. Hunt, George S. 1962. Water pollution and the ecology of some aquatic invertebrates in the lower Detroit River. Univ. Mich. Great Lakes Res. Div. Pub. 9:29-49.

A study regarding waterfowl, their habitat, and their foods was conducted in the vicinity of Grosse Ile, Michigan, during 1948 to 1956. This paper reports the findings made on water quality, underwater soils, and macroscopic invertebrates. Particular effort was made to determine the relationship of snails and fingernail clams to the intensity of water pollution, to other water conditions, and to soils. Bottom samples were collected during 1954 to determine the kinds and numbers of invertebrates in the area studied. A map of the invertebrate aggregations was constructed from the sample data in conjunction with a U.S. Lake Survey chart and aerial photographs.

The following were determined for the soils of the sample sites: physical type, pH, oil content, amounts of phosphorus, calcium, nitrogen, and potassium, and presence of carbonates. The following were determined for the water at each sample site: depth, temperature, pH, and transparency. Additional water data were obtained from the literature. The effects on the invertebrates of the foregoing soil and water factors were discussed. A comparison between this study and two earlier ones was made.

384. Hunt, George S. 1963. Wild celery in the lower Detroit River. Ecology. 44(2):360-370.

Water quality and characteristics, soils, and submerged aquatic plants in the lower Detroit River were studied to determine the relationship of wild celery to the intensity of pollution, other water conditions, and the underwater soil. The aquatic vegetation was assessed qualitatively and quantitatively from 1950 through 1955, and a series of aquatic plant-type maps were developed. (SM)

385. Hunt, George S. and Howard E. Ewing. 1953. Industrial pollution and Michigan waterfowl. In: James

Trefethen (Ed.), Transactions of the Eighteenth North American Wildlife Conference. March 9, 10, 11, 1953. Wildlife Manage. Inst. Washington, D.C. pp. 360-368.

Many ducks have wintered on the Detroit River since industrialization has caused the river to remain open in winter. Three major factors are involved in causing winter mortality: (1) cold weather, (2) starvation, and (3) pollution. Oil, grease and yellow phosphorus are the only known pollutants that have caused death. (SM)

386. Hunt, George S. and Richard W. Lutz. 1959. Seed production by curly-leaved pondweed and its significance to waterfowl. J. Wildlife Manage. 23(4):405-408.

An excellent production of curly-leaved pondweed seeds occurred in a marsh at the west end of Lake Erie in 1958. We believe that a reduction in water levels to a depth of 3 to 12 inches caused this excellent reproductive response. Seeds collected from two milacre plots indicated that one acre would support 500 to 1,000 mallard-sized ducks for one day. A food habits study showed that 11 ducks of 15 collected had used the seeds of this pondweed. Pending replication of the conditions which we believe caused fruiting, we suggest water level management as follows: (1) draw down in spring to leave 3 to 12 inches of water over P. crispus beds, and (2) maintain those depths throughout the growing season. (BU)

Hunter, George W. III - See: Ralph V. Bangham, No. 42, 43.

387. Hunter, George W. III and Ralph V. Bangham. 1932. Studies on fish parasites of Lake Erie. I. New trematodes (Allocreadiidae). Trans. Am. Micro. Soc. 51(2):137-152.

A report on several trematodes collected from Lake Erie fish including detailed descriptions of each. (BU)

388. Hunter, George W. III and Ralph V. Bangham. 1933. Studies on the fish parasites of Lake Erie. II. New cestoda and nematoda. J. Parasitology. 19(4):304-311.

Morphological characteristics of two tapeworms belonging to the Proteocephalidae and of a new nematode are discussed. All specimens were collected in either Eastern or Western Lake Erie

from 1927 to 1929. Habitat descriptions of each species are included. (BU)

389. Hunter, George W. III and W. S. Hunter. 1929. Further experimental studies on the bass tapeworm, Proteocephalus ambloplitus (Leidy). In: A Biological Survey of the Erie-Niagara System. N.Y. State Dept. Cons. Albany, N.Y. Suppl. 18th Ann. Rept. (1928). pp. 198-207.

A comprehensive study of Proteocephalus ambloplitus, the bass tapeworm. Their occurrence in Lake Erie bass and other fish is discussed.

Hunter, W. S. - See: George W. Hunter III, No. 389.

Hyche, C. M. - See: K. K. S. Pillay, et al, No. 637.

390. Hydroscience, Inc. 1973. Limnological systems analysis of the Great Lakes, phase I - preliminary model design. Great Lakes Basin Comm. Ann Arbor, Mich. 474 p.

The purpose of this report is to present an assessment of the feasibility of applying a Limnological Systems Analysis to the water resource problems of the Great Lakes. A demonstration modeling framework was constructed and includes; regional models of Western Lake Erie for chlorides and bacteria, eutrophication model of Western Lake Erie, and food chain model of Western Lake Erie.

Ingersoll, Bruce - See: Arthur D. Hasler, No. 338.

391. International Joint Commission. 1969. Pollution of Lake Erie, Lake Ontario and the international section of the St. Lawrence River. I - Summary. Internat. Lake Erie Water Pollution Bd. and Internat. Lake Ontario-St. Lawrence River Water Pollution Bd. I.J.C. Washington, D.C. 150 p.

This summary report contains a discussion of the excessive algal growth which interferes with water use, the decline in value of fish catches, and bacterial contamination in specified areas along the shore of Lake Erie. Findings are summarized and critical problems of pollution are identified.

392. International Joint Commission. 1969. Pollution of Lake Erie, Lake Ontario and the international

section of the St. Lawrence River. II - Lake Erie. Internat. Lake Erie Water Pollution Bd. and Internat. Lake Ontario-St. Lawrence River Water Pollution Bd. I.J.C. Washington, D.C. 316 p.

This volume contains the scientific and engineering data and findings used to determine the sources and levels of pollution in Lake Erie as well as recommendations for the necessary remedial measures. Biological data include: pesticide residues in fish, phytoplankton, zooplankton, Cladophora, bottom fauna, fish populations, and bacteriological studies.

393. International Joint Commission. 1970. Pollution of Lake Erie, Lake Ontario and the international section of the St. Lawrence River. I.J.C. Washington, D.C. 174 p.

This report of the International Joint Commission deals with an extensive inquiry into the pollution of Lake Erie, Lake Ontario and the international section of the St. Lawrence River. Bacterial and viral contamination are discussed in reference to pollution problems. Included is a section on the effects of pollutants with sub-sections dealing with biological changes, fish, bacterial contamination and wildlife.

394. International Joint Commission. 1973. Semi-annual report of the Research Advisory Board to the International Joint Commission. I.J.C. Washington, D.C. 23 p.

The report consists of: (1) summaries of the two meetings of the Research Activity Board; and (2) compilations of the reports of the seven standing committees which cover specific areas of research. Mention is made of a symposium planned for November 14, 1973 on Viruses in the Environment and Their Potential Hazards. A copy of the symposium announcement is included. Under the heading "Coliforms and Water Recreation" consideration is given to literature published between 1957 and 1973 which challenges the value of the coliform test as an indicator of health hazards in recreational waters.

Jackson, William B. - See: Michael W. Fall, et al, No. 252.

395. Jaques, H. E. 1915. The fish-feeding coleoptera of Cedar Point. Ohio Nat. 15(8):525-528.

It was observed that fish cast upon the beach by waves were reduced to skeletons within a matter of days. Experiments on the part of coleoptera in reducing the fish debris of Cedar Point were conducted and the results presented. (BU)

Jarrett, Thomas M. - See: Edwin L. Peterson, No. 631.

Jaworski, Norbert - See: James McCarty, No. 511.

396. Jennings, H. S. 1898. Trochosphaera again. Science. 8(199):551.

A brief paper discussing the discovery of the rotifer, Trichospaera, in Lake Erie. Samples were collected in a swamp area near Put-in-Bay, Ohio in the summer of 1898. (BU)

Jennings, Otto E. - See: R. Y. Gottschall, No. 293.
W. A. Kellerman, No. 420.

397. Jennings, Otto E. 1906. Additions to the flora of Cedar Point. II. Ohio Nat. 6(8):544-545.

A list of 31 additional flowering plants and ferns collected on Cedar Point in 1905 is given. (BU)

398. Jennings, Otto E. 1908. An ecological classification of the vegetation of Cedar Point. Ohio Nat. 8(6):291-340.

An ecological classification of the vegetational structures on Cedar Point is presented. A total of 6 successions and 48 formations are discussed. (BU)

399. Jennings, Otto E. 1909. A botanical survey of Presque Isle, Erie County, Pennsylvania. Annals Carnegie Mus. Pittsburgh, Penn. Pub. 53. 5(1):289-421.

This study describes the vegetation found on Presque Isle between May and September of 1906. The collections were classified and a systematic catalogue of the ferns and flowering plants of Presque Isle is included. Successions of plants in the various habitats of Presque Isle, including the beach, bays, lagoons, marshes, sand plains, dunes, etc. are described. Comparisons are drawn between vegetation found on Cedar Point, in Western Lake Erie and on Presque Isle. (SM)

400. Jennings, Otto E. 1930. Peregrinating Presque Isle. Carnegie Mag. Pittsburgh, Penn. 4(6):171-175.

This article deals with the succession of plant societies observed on Presque Isle. The author notes that in a walk of three miles remnants of four important plant societies can be seen as well as indications that a climax forest is being formed. Changes in aquatic and shore vegetation were observed from the newer to the older ponds. When a pond is left inland by the further growth of the penninsula, there is an active change in its plant life. Studies indicate that when a pond is of a certain age the appearance of certain types of plants can be expected. These, in turn, replace previously existing vegetation. For example, when a pond is about 40 years old, white and yellow water lilies appear. How they reach the pond is not known. Photographs are included showing the types of vegetation on Presque Isle. (SM)

401. Jennings, Otto E. 1930. A survey of the phytoplankton at Erie, Pennsylvania. Science. 71(1848):560-561.

A report of a study carried out at Erie, Pennsylvania on phytoplankton in Lake Erie. A year-round record is now available based on 250 samples, including about 65 organisms. (SM)

402. Jobes, Frank W. 1952. Age, growth, and production of yellow perch in Lake Erie. U.S. Dept. Interior. Fish and Wildlife Service. Fish. Bull. 70. 52:205-266.

Review of production statistics, 1885-1947, and detailed life-history study. Includes materials on validity of scale readings, body-scale relation, size and age distribution, growth (including annual fluctuations, length of growing season, and growth compensation), length-weight relation and condition (including fluctuations by month and year and according to age and sexual state), maturity, and sex ratio.

403. John Carroll University. 1970. The environmental problems of the Lake Erie Basin. Proc. Am. Values Ser. Conf. Cleveland, Ohio. 37 p.

A record of a conference held on March 24, 1970 and aimed at presenting a fair and objective discussion of Lake Erie. Contributions by six investigators discussing resource management and the physical, chemical, and biological aspects of the lake comprise this publication.

Johnson, Lynn E. - See: Robert D. MacNish, et al, No. 498.

404. Johnson, M. G. and R. O. Brinkhurst. 1971. Associations and species diversity in benthic macroinvertebrates of Bay of Quinte and Lake Ontario. J. Fish. Res. Bd. Can. 28(11):1683-1697.

The objective of this study was to determine the number and character of macroinvertebrate associations in the Bay of Quinte, which is grossly polluted, and the adjacent area of Lake Ontario, which is oligotrophic. This data was compared to that of Lake Erie.

405. Jones, Lynds. 1902. Bird studies in Lorain County, Ohio. Winter studies. Wilson Bull. Oberlin, Ohio. 9(2):37-64.

A record of birds seen on Lake Erie and in Lorain County, Ohio during the winters of 1896-1902. Weather conditions and their probable effect on bird behavior are discussed. (SM)

406. Jones, Lynds. 1902. The summer birds of Lake Erie's Islands. Ohio Nat. 2(8):281-284.

A discussion of sites visited and observed including eggs, nests, squabs, and kinds of birds. (BU)

407. Jones, Lynds. 1903. The birds of Ohio, a revised catalogue. Ohio State Acad. Sci. Columbus, Ohio. Spec. Papers 6. 241 p.

This catalogue is a revision of an 1882 catalogue which was part of the Ohio State Geological Survey. Observations by the author include mention of the influence of Lake Erie on bird migration. He stated that while Lake Erie is not an insurmountable barrier to most species, they seem to prefer not to cross it directly, or not at all, if possible. The catalogue is extensive and includes descriptions of the areas in which the bird has been seen and some comment about its habits. (SM)

408. Jones, Lynds (Ed.). 1906. The birds of Cleveland, Ohio and vicinity. Wilson Bull. Oberlin, Ohio. 18(4):110-120.

A list thought to be about ten years old at the time of publication by the editor. Its author was unknown and the list includes species no longer found in the region in 1906. (SM)

409. Jones, Lynds. 1906. Two birds new to Lorain County, Ohio. Wilson Bull. Oberlin, Ohio. 18(4):130-133.

A brief note about the sighting of the Philadelphia vireo, Vireo philadelphicus, and the western willet, Symphemia semipalmata inornata, on the Lake Erie shore. (SM)

410. Jones, Lynds. 1906. Some migrations along the Cedar Point sand spit, Erie County, Ohio, 1906. Wilson Bull. Oberlin, Ohio. 18(4):128-130.

A short report on birds sighted from Cedar Point in Western Lake Erie during October and November of 1906. The author observed many waterfowl in the marsh area near Huron, Ohio. (SM)

411. Jones, Lynds. 1908. Records from Cedar Point, Ohio. Winter of 1907-1908. Wilson Bull. Oberlin, Ohio. 20(1):55-56.

A brief note recording birds of particular interest seen at Cedar Point from November 1907 to the spring of 1908. Only a small amount of ice formed on the lake and American mergansers, American golden-eyes, and buffleheads remained all winter as well as a large number of herring gulls. (SM)

412. Jones, Lynds. 1909. The birds of Cedar Point and vicinity. Wilson Bull. Oberlin, Ohio. 21(2): 55-76; 21(3):115-131; 21(4):187-204.

A report on eight years of observations beginning in 1890. There is some discussion of the probable migration routes used by various birds along the Lake Erie islands. Notes concerning sightings and a list of species seen are included. (SM)

413. Jones, Lynds. 1910. The birds of Cedar Point and vicinity. Wilson Bull. Oberlin, Ohio. 22(1):25-41; 22(2):97-115; 22(3-4)172-182.

A continuation of the study reported in 1909. Some comparisons are made with the observation of Taverner and Swales on Point Pelee. A total of 254 species is recorded. (SM)

414. Jones, Lynds. 1912. A study of the avifauna of the Lake Erie islands. Wilson Bull. Oberlin, Ohio. 24(1):6-18; 24(2):95-108; 24(3):142-153; 24(4):171-186.

A summary of the author's visits to Cedar Point, Point Pelee, and various Lake Erie islands for the purpose of bird observation. Notes on sightings are included with some details on behavior and nesting sites. This is a journal report with personal comments and suggestions for further study. (SM)

415. Jordan, David S. 1877. On the fishes of northern Indiana. Proc. Acad. Nat. Sci. Philadelphia. Philadelphia, Penn. 29:42-82.

A listing of fish found in waters of northern Indiana. Waters tributary to Lake Erie through the Maumee River and its branch, "St. Joseph's of the Maumee," make up one of the localities studied. In all, about 60 species are represented. Notes and descriptions of the species are included. (SM)

Keener, J. M. - See: H. G. Smith, et al, No. 708.

416. Kehr, William Q. and Charles R. Ownbey. 1964. Water resources problems of the Great Lakes. J. Am. Waterworks Assoc. 56(9):1167-1172.

A general discussion of the water resources of the Great Lakes with comment on lake levels, industrial use, water quality, over-fertilization, urban pollution, pollution from vessels and its control, and public attitudes. The need for action to stem the use of the lakes as a dumping ground is stressed. (BECPL)

Keller, Myrl. - See: John F. Carr, et al, No. 146.

417. Keller, Myrl. 1965. The winter fishery of South Bass Island with a census of the 1963 catch. Ohio J. Sci. 65(6):327-334.

The winter hook and line fishery of the South Bass Island area in Western Lake Erie has contributed phenomenal catches to the angler over the years. This fishery which operates on a sport and commercial basis has had a history of continual changes in species composition of the catch. Early records indicate that herring, Coregonus artedii (LeSeuer), saugers, Stizostedion canadense (Smith), burbot, Lota lota (Linnaeus), and walleye, Stizostedion vitreum vitreum (Mitchill), dominated the catches. During the more recent years yellow perch, Perca flavescens (Mitchill), and American smelt, Osmerus mordax (Mitchill), have dominated the catches.

A creel census of the catch was made during the winter of 1963 to compare the past and present fishery. Estimates of the 1963 catch when compared to previous years were high. The total catch in 1963 was estimated to be 90,280 pounds or 285,280 fish. Of this total, 97.3 percent were yellow perch. American smelt, white bass, Roccus chrysops, and walleye each made up less than 1 percent of the catch.

418. Kellerman, W. A. 1901. Notes on the flora of Sandusky. Ohio Nat. 1(6):82-85.

Contains brief notes on the flora of the Sandusky area. (SM)

419. Kellerman, W. A. 1904. Flora of Hen and Chicken Islands, 1903. Ohio Nat. 4(8):190-191.

A list of the plants found on Little Chick Island, Big Chick Island and Hen Island in August 1903. (BU)

420. Kellerman, W. A. and O. E. Jennings. 1904. Flora of Cedar Point. Ohio Nat. 4(8):186-190.

A list of flowering plants and ferns collected on Cedar Point. (BU)

421. Kellerman, W. A. and H. H. York. 1906. Additions to the flora of Cedar Point. I. Ohio Nat. 6(7):540.

A list of 26 additional flowering plants and ferns collected on Cedar Point during the summer of 1904. (BU)

422. Kellicott, D. S. 1884. Observations on Infusoria with descriptions of new species. Proc. Am. Soc. Micro. Seventh Ann. Meeting. Rochester, N.Y. August 19-22, 1884. pp. 110-124.

A report on freshwater species of Infusoria. Most of the species studied were from Buffalo, New York area with a few from Corunna, Michigan. The Acinta tuberosa Ehr, on a small species of Mysis was identified as being from Lake Erie. (SM)

423. Kendall, William Converse. 1920. The relationship of the so-called blue pike and yellow pike of Lake Erie and Lake Ontario. Trans. Am. Fish. Soc. 50:257-267.

The relationship between the blue pike and yellow pike found in Lake Erie is studied by means of analysis of external morphological characteristics. The author concludes that although there are no specific differences recognizable by the ordinary methods of the systematist, there is in each an aggregate of correlated small differential characteristics of phylogenetic significance. (CCIW)

424. Kennedy, Clarence H. 1922. The ecological relationships of the dragonflies of the Bass Islands of Lake Erie. Ecology. 3(4):325-336.

A study concerning the dragonfly fauna of the Put-in-Bay region. The relationships between the pond and lake species are discussed. The prediction is made that the lake shore will eventually be colonized by specialized Libellulinae. (SM)

Kennedy, R. - See: R. M. Pfister, et al, No. 636.

425. Kennedy, W. A. 1956. Current fisheries research by Canadians on the Great Lakes. Trans. Am. Fish. Soc. 86:419-423.

Canadian research on the Great Lakes is reviewed. It falls into two categories: (1) a contribution towards eliminating sea lamprey from the Great Lakes; and (2) some general fishery research.

426. Kennedy, W. A. 1962. Landlocked sea lamprey in the Great Lakes. Ont. Dept. Lands and Forests. Ottawa, Ont. 12 p.

A general discussion of the sea lamprey including life cycle, introduction to the upper Great Lakes, destructiveness, principles of control and prospects for a lamprey fishery. Mention is made that the first landlocked sea lamprey was found in Lake Erie in 1921, although they never became plentiful there.

427. Kettaneh, Anthony (Ed.). 1971. Troubled waters, Lake Erie, 1971. Great Lakes Res. Inst. Erie, Penn. 121 p.

This volume has been prepared as an introduction to the subject of pollution and pollution abatement in Lake Erie. It is divided into two sections; the first is based on a series of conversations with experts in various fields, and the second consists of a series of bibliographies accompanied

by brief topical abstracts, many of which deal with the biological aspects of pollution in Lake Erie.

428. King, Dennis R. and George S. Hunt. 1967. Effects of carp on vegetation in a Lake Erie marsh. J. Wildlife Manage. 31(1):181-188.

This study was made in 1964 and 1965 at the Erie Shooting Club on Western Lake Erie to determine: (1) the effect of carp on the abundance and species composition of aquatic vegetation; (2) the stage in the life cycle of plants most affected by carp; and (3) the recovery made by vegetation after carp were reduced or eliminated. The data revealed that carp significantly affected the total abundance of vegetation in both years. (BU)

Kingler, Gwendolyn W. - See: Rolf Hartund, No. 337.

Kinney, Edward C. - See: Ralph W. Dexter, No. 223.

429. Kinney, Edward C. 1957. The otter trawl as a fish sampling device in Western Lake Erie. Trans. Am. Fish. Soc. 86:58-60.

Periodic fish collections were made in Western Lake Erie with a thirty foot otter trawl from 1948 to 1953. Prior to 1952 the number of silver chubs, Hybopsis storeriana, per collection was recorded for some of the trips. Bi-weekly trawls, usually consisting of four one-acre hauls, were made during 1952 and 1953. Records of the number of silver chubs per haul were kept. When hauls made during the spring migration period were excluded, a mean of 13.2 adults per haul was obtained with a standard deviation of 4.7. These results were sufficiently consistent to be used as a basis for further population comparisons. (BU)

Kishler, W. Jack - See: J. H. Hubschman, No. 378.
Clarence E. Taft, No. 760.

430. Kishler, W. Jack and Clarence Taft. 1970. Bangia atropurpurea (Roth) A. in Lake Erie. Ohio J. Sci. 70(1):56-57.

Bangia atropurpurea was collected on March 2, 1969 at the State Highway Park on the east shore of Marblehead Peninsula, Ottawa County, Ohio. This is the first record of Bangia in Western Lake Erie. It appeared as lax red-purple tufts, 3/4 inch long, covering a flagstone on the shoreline where there was an opening in the ice.

431. Kisicki, Donald Robert. 1973. Environmental management of the Great Lakes international boundary areas: a case study of the Niagara urban region. N.Y. State Sea Grant Program. Great Lakes Manage. Problem Ser. Albany, N.Y. 301 p.

This study has looked at the environmental problems and government in an international urban environment, the Niagara Frontier. The biological investigation was limited largely to the Niagara River although some mention is made of Lake Erie.

432. Kleiman, Joseph. 1966. Migration of rough-legged hawks over Lake Erie. Wilson Bull. Oberlin, Ohio. 78(1):122.

A short note recording the observation of the rough-legged hawks (Buteo lagopus) flying south off Pelee Point and out of sight on December 6, 1944. (SM)

Kleveno, Conrad - See: Thomas Braidech, et al, No. 32.
Thomas Braidech, et al, No. 33.

433. Klocke, Jessie Finley, Thelma Porter, P. I. Tack, Edna Leffler, Norma Scott Henry and Ruth Nitchals. 1946. Nutritive value of fish from Michigan waters. I. Nicotinic acid of lake herring, carp, common suckers, and burbot. Food Res. 11(2):179-186.

A report on the effects of the environment, season of the year, and processing on the nicotinic acid content of lake herring, carp, burbot and common sucker. Carp specimens were collected from the Michigan waters of Lake Erie. (BU)

434. Klocke, Jessie Finley, Peter I. Tack, Margaret A. Ohlson, Ruth Nitchals, Edna Leffler and Norma Scott Henry. 1947. Nutritive value of fish from Michigan waters. II. Thiamin of lake herring, carp, common sucker, burbot and smelt. Food Res. 12(1):36-43.

The influence of season of the year, environment, freezing, refrigeration holding, baking, and frying on the thiamin content of five species of fish from Michigan water. Carp specimens were collected in Lake Erie. (BU)

Koczaja, Ronald D. - See: David E. Barry, No. 48.

435. Kormondy, Edward J. 1962. Recent evolution along Lake Erie. Explorer. Cleveland, Ohio. 4(2): 12-16.

This article describes the vegetation found in ponds on Presque Isle. The colonization of a new pond and the processes which make the habitat suitable for other clusters of plants and animals are outlined. Estimates of the ages of several ponds are included. (SM)

436. Kormondy, Edward J. 1969. Comparative ecology of sandspit ponds. Am. Mid. Nat. 82(1):28-61.

The limnology, productivity and community metabolism of a series of beach and lagoon ponds in different stages of succession were studied on Presque Isle, a sandspit in Lake Erie at Erie, Pennsylvania from 1960-1963. Macrovegetational characteristics include the replacement of initial colonizers, Chara and Nitella, and the appearance of floating-leaved species in 30-40 years. Phytoplankton density is the greatest in late July to early August with the species diversity greatest in mid-summer. Summer flora is dominated by chlorophytes and cyanophytes, the fall and winter by chlorophytes and chrysophytes, notably diatoms, which also dominate the spring flora. (SM)

437. Kraatz, Walter C. 1923. A study of the food of the minnow Campostoma anomalum. Ohio J. Sci. 23(6):265-283.

The food of the minnow Campostoma anomalum from various Ohio waters was studied. It was found that in adults inorganic material comprises a large percentage of the intestinal contents while plant material is far more abundant than animal. In the young, diatoms comprise one-half to nine-tenths of the total intestinal content. (BU)

Kramer, Jack W. - See: David B. Baker, No. 31.

438. Krecker, Frederick H. 1915. Phenomena of orientation exhibited by Ephemeridae. Biol. Bull. 29(6): 381-388.

A discussion of the reactions of Ephemeridae to air currents, gravity and light. (BU)

439. Krecker, Frederick H. 1916. Sunfish nests of Beimiller's Cove. Ohio J. Sci. 16(4):125-134.

A study was made of the sunfish nests of Beimiller's Cove during July, 1915. The characteristics of the nest and the surface upon which it is built are described. The author attempts to determine those factors which influence the location of a sunfish nest. Also discussed is the effect of sewage upon these nests. (BU)

440. Krecker, Frederick H. 1919. The fauna of rock bottom ponds. Ohio J. Sci. 19(8):427-474.

This investigation was undertaken to study both the fauna and physical changes in a series of rock bottom ponds successively greater in age. Within a radius of fifteen miles of the Sandusky Bay area is a series of five ponds, which at the time of the investigation, were one, five, ten, fifteen and thirty years old. Each pond with its component fauna is discussed. The distribution of the various species through the five ponds is then summarized. (BU)

441. Krecker, Frederick H. 1920. Caddis-worms as agents in distribution of freshwater sponges. Ohio J. Sci. 20(8):355.

A brief discussion of the encrustation of the freshwater sponge, Spongilla fragilis, upon cases of the caddis-fly larva, Rhyacophilidae. (BU)

442. Krecker, Frederick H. 1922. Emergence of a mayfly from its nymphal skin. Ohio J. Sci. 22(6): 155-157.

An account from direct observation of the emergence of a subimago mayfly from its nymphal skin. (BU)

443. Krecker, Frederick H. 1924. Conditions under which Goniobasis livescens occurs in the island region of Lake Erie. Ohio J. Sci. 24(6):299-310.

A discussion of the various habitats and distribution of Goniobasis livescens in both the Put-in-Bay area and the Island region. With reference to distribution, wave action was found to be the controlling factor either indirectly, by moving the substratum, or directly, by moving the snails themselves. (BU)

444. Krecker, Frederick H. 1931. Vertical oscillations or seiches in lakes as a factor in the aquatic environment. Ecology. 12(1):156-163.

In four inches of water along the shores of Lake Erie there were found 66 ndividuals, within an area three feet square, representing eleven different species and in another instance 1,189 individuals representing seventeen species. These forms may be partly or entirely exposed by seiche oscillations resulting in exposure to air and to grinding action of waves. The observations are in the hope that the seiche phenomena will attract more attention in connection with limnological studies. (SM)

445. Krecker, Frederick H. 1939. A comparative study of the animal population of certain submerged aquatic plants. Ecology. 20(4):553-562.

The results reported in this paper are based on a plant by plant examination of seven species of submerged, leafy aquatic plants from the Western Basin of Lake Erie, the examination being made with a view to determining both the composition and quantity of the animal population. The plants examined were Potamogeton compressus, P. pectinatus, P. crispus, Myriophyllum spicatum, Elodea canadensis, Naias flexilis and Vallisneria spiralis. Representatives of 29 genera were found inhabiting this community. (BU)

446. Krecker, Frederick H. 1939. Polychaete annelid worms in the Great Lakes. Science. 89(2302):153.

A specimen of a transparent polychaete annelid worm was found in Lake Erie, by the author, during the summer of 1936 at a depth of 55 feet and 30 miles east of Put-in-Bay. It is compared with a specimen from Lake Superior and designated as Manayunkia eriensis. (SM)

447. Krecker, Frederick H. and Lennie Y. Lancaster. 1933. Bottom shore fauna of Western Lake Erie: a population study to a depth of six feet. Ecology. 14(2): 79-93.

The density of the bottom population and the variety of its forms within the six foot contour of Western Lake Erie were found to depend upon the type of the substratum, the character of the vegetation and the depth of the water. The densest population was in less than 36 inches of water. Half of the

animals represented occurred in maximum numbers within the six inch contour, although, due to great numbers of chironomids, the largest total population was at the 18 inch contour. Shelving rock shore zones were the most densely populated whereas rubble shores, covered with coarse angular or water worn pieces of stone, have the greatest variety of animals present in maximum numbers. The smallest number of forms occurred on sand bottoms. (SM)

Kupiec, Albert R. - See: Daniel G. Bardarik, et al, No. 46.

Lagler, Karl F. - See: Carl L. Hubbs, No. 372, 373, 374, 375.

Lancaster, Lennie Y. - See: Frederick H. Krecker, No. 447.

448. Landacre, F. L. 1901. Sponges and bryozoans of Sandusky Bay. Ohio Nat. 1(6):96-97.

Contains notes on the freshwater sponges, Spongilla, and the freshwater Polyzoa, Plumatella and Pectinatella, occurring at Sandusky, Ohio. (BU)

449. Landacre, F. L. 1908. The protozoa of Sandusky Bay and vicinity. Ohio Acad. Sci. Spec. Paper 13. 4(10):423-470.

A report on collections of protozoa in Sandusky Bay taken in the summers of 1902, 1903 and 1904. A list of the protozoa found is included. Collections were particularly rich in Infusoria and Mastigophora. The plankton of Sandusky Bay was found to be small in quantity and in number of species. This was thought to be because of the unusual amount of sediment in the water when it was agitated by the wind. The most protozoa are found in coves where duckweed, Lemna minor is found in abundance. (SM)

450. Lane, Ferdinand C. 1948. The World's Great Lakes. Doubleday and Co., Inc. Garden City, N.Y. pp. 169-171.

A short section of this book on lakes is devoted to Lake Erie. It describes the lake and the cities along its shore. (SM)

451. Lange, Willy. 1971. Limiting nutrient elements in filtered Lake Erie water. J. Internat. Assoc. Water Pollution Res. Water Res. 5(11):1031-1048.

Biweekly laboratory bioassays were made using filtered Lake Erie waters from the Bass Island region to stimulate the effect of an influx of individual nutrients to Lake Erie water. Each sample during the 1969 growing season was inoculated singly with each of three blue-green algae and one green algal species. Portions of each inoculated water sample were enriched with one of 16 essential nutrient elements and cell numbers were determined in the fourth week after exposure under controlled culture conditions. Comparative cell counts showed nitrate-N was the nutrient most frequently required and was limiting for these algal species in about 2/3 of the water samples. Phosphorus, cobalt and chelated iron were limiting for about 1/3 of their cultures. To achieve maximum growth stimulation generally required a combination of several nutrient elements. An Aphanizomenon bloom occurred naturally in Lake Erie at the water sampling site and after its collapse from nutrient insufficiency, the water samples were found to be toxic to certain of the test algal species. (BECPL)

452. Langford, G. B. 1961. The Canadian Great Lakes research program. Univ. Mich. Great Lakes Res. Div. Proc. 4th Conf. on Great Lakes Res. Pub. 7:199-201.

This paper expresses the authors views supporting extensive Great Lakes research and also the need for a satisfactory method of recording limnological data so that the records will be uniform and available to all scientists working in this area. (RL)

453. Langford, G. B. 1964. The Great Lakes Study Group. Univ. Mich. Great Lakes Res. Div. Proc. 7th Conf. on Great Lakes Res. Pub. 11:15-18.

This paper presents the reasons for the formation of the Great Lakes Study Group, as well as its objectives.

454. Langford, G. B. 1965. The Great Lakes and their problems. Univ. Toronto. Great Lakes Inst. Toronto, Ont. Rept. PR 21. 30 p.

A pamphlet describing factors which influence the water quality of the Great Lakes. Low lake levels, algal growth, nutrients and detergents are among the topics considered. Comparisons are drawn between research on water quality in the United States and that being done in Canada. There is some discussion of pesticides and the discharge of heated water in the lakes. (CCIW)

Langlois, Marina H. - See: Thomas H. Langlois, No. 465.

455. Langlois, Thomas H. 1945. Ohio's fish program - a guide for best use of the Buckeye state's renewable resources of fishes. Ohio Dept. Agric. Div. Cons. Nat. Resources. Columbus, Ohio. pp. 35-39.

This article presents and discusses methods of attempting to maintain the fish population of Lake Erie at a high level.

456. Langlois, Thomas H. 1946. The herring fishery of Lake Erie. Inland Seas. 2(2):101-104.

Historical background on the herring fishery from its inception around 1880 to 1945. The decline of the industry hit in 1925; since then it has fluctuated. Possible reasons for this decline are presented along with some facts about the life history of the herring. (CCIW)

457. Langlois, Thomas H. 1947. Sidelights on the Erie Isles. Inland Seas. 3(3):173-179.

This article relates some of the early history of the Lake Erie islands. Information was gathered from family record books and notes. Comment is made about the spearing of sturgeon and use of the pound net for fishing. (CCIW)

458. Langlois, Thomas H. 1954. The Western End of Lake Erie and Its Ecology. J. W. Edwards, Inc. Ann Arbor, Mich. 479 p.

A report summarizing a series of studies made during a span of 60 years. Its aim is to supply a basis for a fish management program for Ohio waters of Lake Erie. A review of studies on the flora and fauna of Lake Erie is included. There is extensive discussion of the techniques used by Lake Erie fishermen and possible causes of changes in the catch. Sewage treatment plants in Ohio cities bordering Lake Erie are described. (SM)

459. Langlois, Thomas H. 1964. Amphibians and reptiles of the Erie islands. Ohio J. Sci. 64(1):11-25.

A catalogue of 31 species of reptiles and amphibians found in the vicinity of Put-in-Bay, on South Bass Island, Ottawa County, Ohio, between 1936 and 1961. Characteristics such as diet and habitat are recorded when available.

460. Langlois, Thomas H. 1964. Hackberry butterflies at South Bass Island. Explorer. Cleveland, Ohio. 6(3):8-11.

Observations and photographs of the hackberry butterfly which repeatedly defoliated a grove of hackberry trees on South Bass Island between 1949 and 1953. The trees were destroyed. (SM)

461. Langlois, Thomas H. 1964. Lake Erie: Progress towards disaster. In: J. R. Dymond (Ed.), Fish and Wildlife. T. H. Best Printing Co. Limited, Can. 9 p.

Reference is made to anoxic conditions in the island region of Lake Erie and resulting mortality of mayfly larva, and the development of sulfur bacteria, Sporophilus, and areas inhabited only by oligochaetes and bloodworms. There is discussion of changes in dominant species of fish with elimination of northern forms and growing numbers of southern forms such as gizzard shad, carp and catfish. Proposals are made for rejuvenation of the lake to save the fisheries.

462. Langlois, Thomas H. 1965. The conjugal behavior of the introduced European giant garden slug, *Limax maximus* L., as observed on South Bass Island, Lake Erie. Ohio J. Sci. 65(5):298-304.

A pair of giant garden slugs, though permaphrodies hermaphrodites, behave as if one were male and one were female during the period just preceding, during, and after mating. A description of this behavior, with photographs, is presented, and the possibility of protandrism is suggested. (BU)

463. Langlois, Thomas H. 1965. Early Lake Erie survey. Explorer. Cleveland, Ohio. 7(1):24-25.

This short article describes the movement of 270 French soldiers and officers in ten canoes from Presque Isle to Detroit. The trip took from July 31, 1754 to August 6, 1754.

The distance was calculated by recording times of departure and arrival, counting the strokes per minute, and estimating the distance covered by each stroke of the oars. The total distance traveled was estimated to be 195.5 miles. (SM)

464. Langlois, Thomas H. 1965. Portage River watershed and fishery. Ohio Dept. Nat. Resources. Div. Wildlife. Columbus, Ohio. Pub. W-130. 22 p.

This publication contains a study of the factors which influence fish populations in the watershed. It contains a list of species found from 1940 to 1961, numbering 69 species. Methods of improving this watershed are also discussed.

465. Langlois, Thomas H. and Marina H. Langlois. 1948. South Bass Island and Islanders. Ohio State Univ. Franz Theodore Stone Lab. Put-in-Bay, Ohio. 139 p.

A historic account of the islands with attention to climate, geology, native plants and animals and the ways in which they influence, and are influenced by, the lives of the islanders. Included is a description of the Franz Theodore Stone Laboratory at Put-in-Bay.

Lanighan, Matthew C. - See: Joseph Puleo, et al, No. 647.

466. La Rocque, Aurèle. 1953. Catalogue of the recent mollusca of Canada. National Mus. Can. Queen's Printer, Ottawa, Ont. Bull. 129. 406 p.

A catalogue listing all species found within the geographic boundaries of Canada. There is some discussion of the economic importance of the mollusca for human and animal food and as water scavengers and purifiers. Attributed to Lake Erie are: Unionidae, naiades, Sphaeriidae and Lymnaea. (SM)

467. Larsen, Alfred. 1954. First record of the white perch (Morone americana) in Lake Erie. Copeia. 1954(2):154.

A single white perch (Morone americana) was caught on each of the following dates--June 20, July 20, and July 27, 1953--by a commercial fisherman 8.5 miles west of Erie, Pennsylvania. This is thought to be the first record of this species above Niagara Falls. (SM)

468. Lawler, G. H. 1961. Abnormalities in Lake Erie whitefish. J. Fish. Res. Bd. Can. 18(2):283-284.

The commercial whitefish catch from Lake Erie in the years 1947 to 1949, which was primarily 1944 year-class, was examined and morphological notes were made on all fish handled. Visable abnormalities were noticed in 11% of the 1709 whitefish examined. In 1956, 108 Lake Erie whitefish were examined and 10% had abnormal caudal fins. The most common abnormality found in 9% of the samples was that the dorsal lobe of the caudal fin was considerably shorter than the ventral lobe. (SM)

469. Lawler, G. H. 1961. Egg counts of Lake Erie whitefish. J. Fish. Res. Bd. Can. 18(2):293-294.

The ovaries of 15 whitefish collected from Lake Erie in 1948 were removed and weighed. Egg samples were removed from each ovary and weighed. These eggs were counted and the total egg count per fish was estimated from the ratio of the weight of the eggs sampled to the total weight of the ovary. The average number of eggs in whitefish of the 1944 year-class was 47,000; the egg count of the 1940 year-class was over 100,000. Average egg diameter of 13 whitefish ranged from 0.95 mm to 1.40 mm. (SM)

470. Lawler, G. H. 1965. Fluctuations in the success of year-classes of whitefish populations with special reference to Lake Erie. J. Fish. Res. Bd. Can. 22(5):1197-1227.

The factors associated with fluctuations in the success of year-classes of whitefish populations of Lake Erie and other lakes are discussed. These factors include: size of spawning populations, extent of fry planting, temperature, turbidity, wind velocity, precipitation, and water levels.

471. Lawrence, W. Mason. 1954-55. The Great Lakes fisheries. N. Y. State Dept. Env. Cons. Albany, N.Y. Conservationist. 9(3):12-13.

This article outlines the task faced by the Great Lakes Fishery Commission which had recently been formed by the United States and Canada under the agreement of the Convention on Great Lakes Fisheries. The value of the commercial catch in New York waters of Lake Erie in 1952 was about $170,000. Fifteen species contributed to the catch and whitefish and blue pike were the most important. The growth of sport fishing is also mentioned. (SM)

472. Lawrie, A. H. 1970. The sea lamprey in the Great Lakes. Trans. Am. Fish. Soc. 99(4):766-775.

The sea lamprey was inadvertently introduced above Niagara Falls by the development of the Welland Canal between Lakes Ontario and Erie. A major population did not develop in Lake Erie but the species rapidly established itself as a highly significant predator in all three upper lakes. Its most obvious effect was the virtual extermination of the lake trout which had been the mainstay of the fishery. Efforts were made to limit sea lamprey reproduction by blocking

the major spawning runs. These measures helped define the scope of the problem and generated considerable knowledge of the fluvial phase of the animal's life history but apparently exerted no significant restraint on population growth. Later control measures employed lamprey specific selective toxicants to destroy larval populations in stream and estuarine habitats.

473. League of Women Voters. 1966. Lake Erie: Requiem or reprieve? League of Women Voters. Lake Erie Basin Comm. Cleveland, Ohio. 50 p.

This publication is a description of Lake Erie and its relationship to the economic and social development of the Lake Erie region. It describes ways in which population pressures and industrial growth have hastened the aging of the lake and reviews the necessary actions which must be taken to preserve Lake Erie as a viable resource. There is discussion of clean-up programs and the agencies involved in implementing legislation and regulations designed to abate pollution.

Lee, G. Fred - See: E. Gus Fruh, et al, No. 273.

Leffler, Edna - See: Jessie Finley Klocke, et al, No. 433.
Jessie Finley Klocke, et al, No. 434.

474. Lehman, Jacob W. 1973. Tritium cycling in a Lake Erie marsh ecosystem. Internat. Assoc. Great Lakes Res. Proc. 16th Conf. on Great Lakes Res. pp. 65-75.

Preliminary results of tritium (^3H) cycling in a Lake Erie marsh ecosystem are presented. The objective of the research was to determine if bioaccumulation and translocation of tritium occur in a marsh ecosystem. Air, water, water vapor, sediment cores and invertebrate samples were collected from a two-hectare study unit which had been treated with approximately 1 curie of tritium. An exponential loss rate of tritium from the treated water was determined. Tritium loss by evaporation was determined to parallel the loss rate from the water. A possible tritium sink was indicated from the ^3H activities of the sediment cores. Invertebrate samples of two snail species (Viviparus malleatus and Lymnaea exilis) and glass shrimp (Palaemonetes sp.) were analyzed for tritium activity. In general the tritium uptake and loss paralleled the tritium activity in the water, though niche preferences affected these rates. No long-term bioaccumulation of tritium was indicated, but there was an indication of translocation

of tritium through the food chain. Further research should indicate more definite trends.

475. Leopold, Luna B. 1970. Discussion and summary. In: The Environmental Problems of the Lake Erie Basin. John Carrol Univ. Carroll Business Bull. Cleveland, Ohio. 10(1):23-32.

A panel discussion of the ecosystem of the Lake Erie Basin including comment on nutrient build-up, the function of swamps, and the effect of silt on fisheries.

476. Leshniowsky, Walter O., Patrick R. Dugan, Robert M. Pfister, James I. Frea and Chester I. Randles. 1970. Adsorption of chlorinated hydrocarbon pesticides by microbial floc and lake sediment and its ecological implications. Internat. Assoc. Great Lakes Res. Proc. 13th Conf. on Great Lakes Res. pp. 611-618.

Of thirty-eight aerobic bacteria isolated from Lake Erie, 14 formed flocs in at least one of six different media used. Two of these floc formers were examined for ability to accumulate aldrin from solution. Aldrin (10^{-6}g/ml) was dissolved in acetone and added to flasks containing pregrown bacterial flocs suspended in water. Flocs were shaken for various time intervals and separated from solution by centrifugation. Both were analyzed separately for presence of aldrin using gas liquid chromatography.

Contemporary sediment collected from Lake Erie was examined microscopically, analyzed for pesticide content and ability to adsorb aldrin. Bacterial flocs adsorbed aldrin from solution giving a 625X concentration factor within 20 minutes after which there was no further increase. The collected sediment behaved similarly.

Floc forming microbes settling from a water column remove pesticides and represent a natural purification process. The pesticides may then accumulate in bottom sediments and exert a toxic effect on susceptible fauna.

477. Leshniowsky, Walter O., Patrick R. Dugan, Robert M. Pfister, James I. Frea and Chester I. Randles. 1970. Aldrin, removal from lake water by flocculent bacteria. Science. 169(3949):993-995.

Floc-forming bacteria isolated from Lake Erie adsorb and

concentrate aldrin from colloidal dispersion so that the settling of the bacterial flocs removes aldrin from the water phase. Contemporary sediments forming in Lake Erie contain aldrin and could adsorb more. The sediments consist of a conglomerate floc of bacteria, diatoms, and inorganic and detrital particles. Flocculent bacteria also adsorb microparticulates and this adsorption capacity represents a mechanism for sediment formation and for the removal of suspended particles including aldrin from the water column. (SM)

478. Le Sueur, C. A. 1817. An account of an American species of tortise not noticed in the systems. Lake Erie tortise. J. Acad. Nat. Sci. Philadelphia. Philadelphia, Penn. 1(1):86-88.

A report on the discovery of a tortise, bearing resemblance to _T. reticulata_ of Bosc, and _T. serrata_ of Daudin, in a marsh bordering Lake Erie in 1816. A plate of the specimen, _Testudo geographica_, is included. (SM)

479. Le Sueur, C. A. 1817. A new genus of fish, of the order Abdominales, proposed under the name of _Catostomus_; and other characters of this genus, with those of its species indicated. J. Acad. Nat. Sci. Philadelphia. Philadelphia, Penn. 1(1):88-96, 102-111.

Six species of _Catostomus_ are described. _Catostomus aureolus_ is attributed to Lake Erie. _C. nigricans_, the black sucker or shoemaker, was found near Buffalo. (SM)

480. Le Sueur, C. A. 1818. Description of several new species of North American fishes. J. Acad. Nat. Sci. Philadelphia. Philadelphia, Penn. 1(2): 222-235, 359-368, 413-417.

The species described come from various parts of the country. Those attributed to Lake Erie include: (1) _Coregonus artedi_, a very delicate food called the herring salmon; and (2) _Coregonus albus_, Lake Erie whitefish.

A proposal is made that a new genus, _Hiodon_, be established to include the several fish of the Ohio River and Lake Erie known under the popular name of herring. Two species were described of this genus: (1) _Hidon tergisus_, observed in Lake Erie at Buffalo; and (2) _Hidon clodalus_, which was not a Lake Erie specimen. Also described was the _Esox estor_,

called pike, pickrel and muskallonge. A specimen three feet long was taken at Buffalo. (SM)

481. Le Sueur, C. A. 1822. Description of the five new species of Genus Cichla of Curvier. J. Acad. Nat. Sci. Philadelphia. Philadelphia, Penn. 2(1): 214-221.

The species attributed to Lake Erie include: (1) Cichla *oenea, a fish 8-10 inches in length taken at Presque Isle; (2) Cichla fasciata, said to be one of the best table fish of Lake Erie and called the black bass by fishermen; (3) Cichla ohioensis, found in both Lake Erie and the Ohio River; and (4) Cichla *minima, found in lagoons of tranquil waters which discharge into Lake Erie. (SM)

482. Le Sueur, C. A. 1822. Description of three new species of the Genus Sciaena. J. Acad. Nat. Sci. Philadelphia. Philadelphia, Penn. 2(2):251-256.

A brief description of the author's experience in finding the sheepshead discarded by fishermen on the Lake Erie shore in July of 1816. This fish is compared with the sheepshead of the Ohio River. Sciaena *oscula inhabits Lake Erie; Sciaena *grisaea the Ohio River; and Sciaena *multifaciata is found in East Florida. (SM)

483. Le Sueur, C. A. 1824. On three new species of parasitic Vermes, belonging to the Linnaean Genus Lernaea. Proc. Philadelphia Acad. Sci. Philadelphia, Penn. 3(2):286-293.

The Lerneocera cruciata is described as a parasite of Cichla aenea nobis (rock bass). The other two parasites which were described, L. radiata and Lerneopenna blainvillii are not attributed to Lake Erie. (SM)

484. Letson, Elizabeth J. 1909. A partial list of the shells found in Erie and Niagara Counties, and the Niagara Frontier. Bull. Buffalo Soc. Nat. Sci. Buffalo, N. Y. 9(2):239-245.

A list of species of fresh water shells, found in the vicinity of Buffalo, New York, from the records of the Conchological Section of the Buffalo Society of Natural Sciences. It is intended to assist collectors in knowing what has been found in various areas. Tributaries to Lake Erie and the lake itself have yielded the following: Goniobasis livescens Mke.;

Campeloma decisum Say; *Polygra albolabris* var. *denta* Try.; *Pyramidula alterna* Say; *Succinea retusa* Lea.; *Physa niagarensis* Lea.; *Lampsilis ventricosus* Barnes; *Lampsilis alatus* Say; *Unio gibbosus* Barnes; and *Quadrula coccinea* Conr. (SM)

485. Lewis, C. F. M., T. W. Anderson and A. A. Berti. 1966. Geological and palynological studies of early Lake Erie deposits. Univ. Mich. Great Lakes Res. Div. Proc. 9th Conf. on Great Lakes Res. Pub. 15:176-191.

Coring and echo sounding of Lake Erie bottom sediments have indicated a thin lag concentrate of sand, in places with plant detritus, pelecypods, gastropods and other fossils, underlying recent silty clay muds and overlying clay till or late-glacial lacustrine clays. Buried shallow pond organic sediments in the Western Basin and relict beach deposits, wave-cut terraces and intrabasinal discharge channels in the Central Basin, some of which are buried, all indicate former low water levels in Central and Western Lake Erie much below those at present. This evidence, combined with radiocarbon dates of 10,200 and 11,300 years B.P. on the organic material and information from nearby regions, suggests that early Lake Erie came into existence about 12,400 years ago.

Examination of the cores indicated that pollen is sufficiently abundant and well preserved in the sediments for palynological studies. Pollen diagrams can be correlated with one another, and with those outside of the Lake Erie Basin. Palynological studies support the geological evidence of a low lake stage and provide a means for dating and correlating sediment sequences which do not contain enough organic matter for radiocarbon analysis.

486. Lewis, Donald W. 1969. Some factors associated with the decline of the Lake Erie commercial fishing industry in Ohio. Internat. Assoc. Great Lakes Res. Proc. 12th Conf. on Great Lakes Res. pp. 834-842.

This study considers the major factors associated with the decline of the Ohio fishing industry. Included is a discussion on the changes in the fish populations of Lake Erie, which comprise the sole resource base for the industry.

Lisk, Donald - See: Irene S. Pakkala, et al, No. 619, 620.
Raymond J. Lovett, et al, No. 489.

Liu, D. L. S. - See: B. J. Dutka, et al, No. 240.

487. Loeb, Howard C. 1954. Experimental carp control. N. Y. State Dept. Env. Cons. Albany, N. Y. Conservationist. 9(1):10-11.

An experimental carp control research project was initiated under Dingell-Johnson federal aid funds. Two points were investigated: (1) does carp control benefit game and pan fish, and if so, in what manner and in which waters; and (2) if the more desirable species are significantly benefited will control be economically feasible?

Large commercial catches of carp are being taken from bays of Lake Erie. Several states have promoted sport fishing for carp in winter and summer. (SM)

488. Loftus, K. H. 1960. Current status of fisheries research projects. Univ. Mich. Great Lakes Res. Div. Proc. 3rd Conf. on Great Lakes Res. Pub. 4:115-119.

A report covering the progress and immediate plans of the Fisheries Section, Division of Research, Ontario Department of Lands and Forests. Reports for Lakes Erie, Huron, and Ontario were prepared; only the Lake Erie report is presented here. (RL)

489. Lovett, Raymond J., Walter H. Gutenmann, Irene S. Pakkala, William D. Youngs, Donald J. Lisk, George E. Burdick and Earl J. Harris. 1972. A survey of the total cadmium content of 406 fish from 49 New York State fresh waters. J. Fish. Res. Bd. Can. 29:1283-1290.

Fish from New York State fresh waters were surveyed for total cadmium. The majority of the samples contained 20 ppb or below. The remainder showed concentrations up to 100 ppb with only a few above this level. Ninety-nine fish from nine species were collected from a sampling station in Eastern Lake Erie; only one of these contained in excess of 100 ppb cadmium. The length, weight, and mean residue concentration is given for each species collected.

490. Lowden, Richard M. 1969. A vascular flora of Winous Point, Ottawa and Sandusky Counties, Ohio. Ohio J. Sci. 69(5):257-285.

This study describes the present-day vascular flora of the marshes, woodlots, dikes, and drainage ditches of Winous

Point, which is located approximately 3-1/2 miles southwest of Port Clinton, Ohio near the mouth of Muddy Creek, at the western end of Sandusky Bay. Vascular plants found are recorded in a catalogue. Changes in the floristic composition of the marshes are discussed by comparing A. J. Pieters' observations (1901) of some marsh plants at the western end of Lake Erie with the present marsh flora.

491. Lucas, Allen M. and Nelson A. Thomas. 1971. Sediment oxygen demand in Lake Erie's Central Basin - 1970. Internat. Assoc. Great Lakes Res. Proc. 14th Conf. on Great Lakes Res. pp. 781-787.

Sediment oxygen demand (SOD) rates were measured at five locations in Lake Erie's Central Basin in June, August and September 1970. The rates were determined from changes in the dissolved oxygen concentration of water sealed and circulated within black and clear plexiglass chambers imbedded in the lake bottom. SOD rates recorded in June varied from 1.2 to 2.2 gm O_2/m^2/day and were indicative of eutrophic conditions. In August, rates measured during the daylight hours with the clear chamber (0.0-0.4 gm O_2/m^2/day) were less than those measured at night with the clear chamber or with the black chamber during the day (0.7-1.0 gm O_2/m^2/day). Oxygen produced by the photosynthetic activity of algae on the lake bottom offset the SOD during part of the day resulting in daily SOD rates of 0.4 to 0.7 gm O_2/m^2/day. Rates measured in September with oxygenated surface water trapped and carried to the bottom in the chambers ranged from 1.0 to 2.4 gm O_2/m^2/day.

492. Lucas, Allen M. and Nelson A. Thomas. 1972. Sediment oxygen demand in Lake Erie's Central Basin. In: Noel M. Burns and Curtis Ross (Eds.), Project Hypo: An Intensive Study of the Lake Erie Central Basin Hypolimnion and Related Surface Water Phenomena. U.S.E.P.A. Tech. Rept. TS-05-71-208-24. pp. 45-50.

See abstract 491.

Lucas, H. F. Jr. - See: M. M. Thommes, et al, No. 766.

493. Lucas, H. F. Jr., D. N. Edgington and P. J. Colby. 1970. Concentrations of trace elements in Great Lakes fishes. J. Fish. Res. Bd. Can. 27(4):677-684.

The concentrations of fifteen trace elements were determined by activation analysis of samples of whole fish and fish livers from Lakes Michigan, Superior and Erie. The concentrations varied with species and lake. (BU)

494. Luck, Alan D. 1967. Lake Erie - A study in resource geography. Univ. Okla. Norman, Okla. M.A. Thesis. 79 p.

A review of the physical characteristics, changes in hydrology, and economic impact of pollution in Lake Erie. Included is a detailed listing of the industries adding pollutants to the lake and its biological consequences. The conclusion is made that several uses of the lake have been damaged, lessened, or destroyed and that Lake Erie as a whole can definitely be termed polluted.

495. Ludwig, James Pinson. 1969. Great Lakes gulls. Limnos. 2(1):3-11.

The general characteristics and habits of the Great Lakes gulls are discussed. Included are environmental factors affecting their habitats.

Lutz, Richard W. - See: George S. Hunt, No. 386.

496. Lyman, F. Earle. 1944. Notes on emergence, swarming, and mating of *Hexagenia* (Ephemeroptera). Entomology News. 55:207-210.

The western end of Lake Erie produces yearly prodigious numbers of *Hexagenia* mayflies belonging to three species: *H. limbata* (Serville), *H. rigida* McDunnough, and *H. affiliata* McDunnough, named in order of relative abundance and seasonal emergence. The emergence, swarming, and mating behavior of these organisms are discussed. (BU)

497. MacCallum, Wayne R. and Henry A. Regier. 1970. Distribution of smelt, *Osmerus mordax*, and the smelt fishery in Lake Erie in the early 1960's. J. Fish. Res. Bd. Can. 27(10):1823-1846.

A report on the seasonal, horizontal and vertical distributions of young-of-the year, yearling and adult smelt of Lake Erie. Also included is an examination of commercial fishing statistics. All data was collected during the late 1950's and 1960's. (BU)

MacDonald, Harold C. - See: Richard H. Benson, No. 64.

498. MacNish, Robert D., Ralph C. Heath, Lynn E. Johnson, Richard A. Wilkens and Richard D. Duryea. 1969. Bibliography of the ground-water resources of New York through 1967. U.S. Geol. Surv. and N.Y. Water Resources Comm. Albany, N.Y. Bull. 66. 186 p.

With the growth of population and the increase in pollution of lakes, streams and aquifers, knowledge of the water-bearing zones below the earth's surface becomes more important. This annotated bibliography lists references up to 1967 concerning water-bearing strata. Among the listings is mention of a study of ground-water discharge to streams in the Lake Erie-Niagara River Basin.

Magath, Thomas B. - See: Henry B. Ward, No. 850.

499. Mague, T. H. and R. H. Burris. 1973. Biological nitrogen fixation in the Great Lakes. BioScience. 23(4):236-239.

This study, conducted in September of 1970, found that acetylene reduction (a measure of biological N_2 fixation) by the phytoplankton in Lake Superior, the western end of Lake Huron, and Eastern Lake Michigan was barely detectable. In Southern Green Bay and the shallow basin of Lake Erie, however, it was comparable in rate to that in eutrophic Wisconsin lakes. (SM)

500. Maher, F. P. 1969. Our changing fish populations of the Great Lakes. Ont. Fish Wildlife Rev. 8(1):3-9.

Over the past one hundred years, the Great Lakes have undergone great changes in species composition and relative abundance of fishes. Environmental changes (notably those caused by pollution) have contributed, but the introduction of new fish (either planned or otherwise) has had the greatest effect. The latter is discussed.

501. Maher, F. P. 1970. Extinct, rare and endangered fishes in Ontario. Ont. Fish Wildlife Rev. 9(1):9-14.

A discussion of several species of fish in Ontario waterways which are extinct, rare or endangered. Probable causes for their disappearance are included. (CCIW)

502. Mallard, Gail E. and James I. Frea. 1972. Methane production in Lake Erie sediments: temperature and substrate effects. Internat. Assoc. Great Lakes Res. Proc. 15th Conf. on Great Lakes Res. pp. 87-93.

Methane produced in the laboratory by microorganisms in Lake Erie sediment was monitored. The effects of variation in temperature and the addition of various compounds as additional substrate were noted.

503. Manion, Patrick J. 1972. Variations in malanophores among lampreys in the upper Great Lakes. Trans. Am. Fish. Soc. 101(4):662-666.

Data is given on the frequency of occurrence of the yellow variants of lamprey in Lakes Superior and Michigan. Mentioned is the fact that this yellow variant has also been found in Lake Erie and its tributaries. (BU)

Mansey, E. L. - See: G. F. Carpenter, et al, No. 144.

Manz, Jerry V. - See: Clyde A. Allbaugh, No. 8.

504. Manz, Jerry V. 1964. A pumping device used to collect walleye eggs from offshore spawning areas in Western Lake Erie. Trans. Am. Fish. Soc. 93(2):204-206.

A description and evaluation of a pumping device used to collect bottom samples, especially fish eggs, from Western Lake Erie. (BU)

Marion, C. V. - See: A. S. Menon, et al, No. 520, 521.

505. Marshall, Anne Corinne. 1939. A qualitative and quantitative study of the Trichoptera of Western Lake Erie. Annals Entomological Soc. Am. 32(4):665-688.

This study is based on a collection of 70,000 specimens representing 7 families, 21 genera and 47 species. Graphs are presented which indicate that some species occur in two broods per season while others are definitely limited to one. The purpose of the paper is to record a listing of the species of Tricoptera of Western Lake Erie which are attracted to light traps and to discuss some of the aspects of their relative abundance and seasonal distribution. (SM)

506. Marshall, J.S., A. M. Beeton and D. C. Chandler. 1964. Role of zooplankton in the freshwater strontium cycle and influence of dissolved salts. Verh. Internat. Verein. Limnol. 15:665-672.

A report on a study of the freshwater strontium cycle using radioassay techniques. The test organism employed was Daphnia magna.

507. Marshall, Nelson. 1942. Night desertion by nesting common terns. Wilson Bull. 54(1):25-31.

A report of observations made on Lake Erie islands in 1939, 1940, and 1941. Night desertion behavior by the common tern is frequently initiated by a distinctive group flight at twilight on Starve Island in Western Lake Erie. The terns return to their nests at dawn. The underlying causes of this lapse in attentiveness within the breeding colony is unknown despite three seasons of study. This desertion has been accompanied by repeated nesting failures. (SM)

508. Marshall, Nelson. 1943. Factors in the incubation behavior of the common tern. Auk. 60:574-575.

A report on a study of the common tern, Sterna hirundo hirundo, conducted primarily on Starve Island in Western Lake Erie during 1939 and 1940. Experiments involved alteration of the number of eggs in a nest, emptying nests, replacing eggs with rocks, and nest recognition. (SM)

Masters, Charles O. - See: Joseph Puleo, et al, No. 647.

509. Mastin, Mary. 1970. Game fish and the parasite problem. Audubon. Can. Audubon Soc. Toronto, Ont. 32(2):59-62.

A discussion of parasites which commonly affect game fish. Included are photographs of Lake Erie white bass infected with Triaenophorus nodulosus; and Lake Erie perch infected with "black grub" or black spot infection. Ways in which the fisherman may inadvertently spread parasites by dumping minnows of undetermined origin into lakes and streams at the end of the day, or be careless cleaning of fish, are mentioned. (SM)

510. McCabe, Patricia M. and James I. Frea. 1971. Effect of mineral particulates on microbial degradation of solid organic materials. Internat. Assoc. Great Lakes Res. Proc. 14th Conf. on Great Lakes Res. pp. 44-51.

In an aqueous medium, strong interactions occur between mineral particulates and (1) the mycelium of a streptomycete, (2) solid proteinaceous substrates and (3) the extracellular enzyme of the streptomycete. We have demonstrated adherence of kaolin to cell and substrate surfaces. We assayed kaolin-adsorbed enzyme by its ability to release azo dye conjugated to collagen, and to degrade collagen structure. In a cell free system, kaolin-enzyme and kaolin-substrate interaction effects two enhancements of enzyme activity. Addition of kaolin to dilute enzyme solutions is a rapid method of concentrating active enzyme. Adherence of enzyme-coated kaolin to degradable material places the enzyme in immediate contact with substrate.

511. McCarty, James and Norbert A. Jaworski. 1972. Ancillary research activities of EPA. Interagency Committee Mar. Sci. and Eng. of the Federal Council Sci. and Tech. Washington, D.C. Proc. First Federal Conf. on the Great Lakes. pp. 95-102.

This paper contains a description of the National Eutrophication Research program at the Pacific Northwest Environmental Research Laboratory, Corvallis, Oregon. The program provides technical assistance in algal assay methodology and determinations, provides algal cultures to other institutions, and advises on methods to monitor eutrophic conditions. It also provides general consultation to the enforcement agencies in Lake Erie.

512. McCay, C. M. 1929. Studies upon fish blood and its relation to water pollution. In: A Biological Survey of the Erie-Niagara System. N.Y. Dept. Cons. Albany, N.Y. Suppl. 18th Ann. Rept. (1928). pp. 140-149.

A survey of the effects of water pollution upon the blood of certain fish. These pollution factors which determine whether or not a fish can survive in a stream reflect immediately in the blood. The fish surveyed were collected in Lake Erie.

McCrimmon, H. R. - See: A. H. Berst, No. 66.

513. McDermott, P. W. 1947. Snake stories of the Lake Erie islands. Inland Seas. 3(2):83-88.

A collection of anecdotes concerning snakes on the Lake Erie islands. References go back to the journal of Father Charlevoix who passed along the north shore of Lake Erie in 1721. Indian tales concerning snakes and stories handed down from early settlers are included. (CCIW)

514. McKee, Russell. 1966. Great Lakes Country. Thomas Y. Crowell. New York, N.Y. 242 p.

This book describes the history and present condition of the Great Lakes. The changing fish populations and bottom dwellers in Lake Erie are mentioned. Emphasis is on the way in which people around the lakes have lived and the use they have made of the lakes. (SM)

515. McLaughlin, Allen J. 1911. Sewage pollution of interstate and international waters with special reference to the spread of typhoid fever. I. Lake Erie and the Niagara River. U.S. Hygenic Lab. Washington, D.C. 169 p.

A review of conditions of public water supply along the south shore of Lake Erie in 1911 with special reference to outbreaks of typhoid fever and the type of water supply used in the municipalities. Discussion of water treatment by filtration is included. Coliform counts at water intakes serving Lake Erie, Pennsylvania were taken and compared with open lake water outside Presque Isle. A decision was made to move public water intakes out of the polluted harbor. (BECPL)

516. McMillan, Gladys L. and Jacob Verduin. 1953. Photosynthesis of natural communities dominated by Cladophora glomerata and Ulothrix zonata. Ohio J. Sci. 53(6):373-377.

The littoral zone in Western Lake Erie is populated by attached filamentous algal communities dominated in summer by Cladophora glomerata (L.) Kutz, and in winter by Ulothrix zonata (Weber & Mohr) Kutz. During 1950-51 these communities were studied to determine their photosynthetic activity under near natural conditions. Graphs showing the relationship between photosynthesis and light intensity are reproduced and discussed. (BU)

McNair, T. - See: R. M. Pfister, et al, No. 636.

517. McQuate, Arthur G. 1956. Photosynthesis and respiration of the phytoplankton in Sandusky Bay. Ecology. 37(4):834-839.

A study of photosynthesis and respiration of natural phytoplankton communities in Sandusky Bay, on the southwest shore of Lake Erie, was made from February 2 to June 18, 1954. Total photosynthesis expressed in micromoles CO_2 absorbed/hour/mg against light, standing crops, dry weight and decimal reduction distance (DRD) is graphed and discussed. (BU)

518. Melin, Brian E. and Robert C. Graves. 1971. The water beetles of Miller Blue Hole, Sandusky County, Ohio (Insecta: Coleoptera). Ohio J. Sci. 71(2):73-77.

Thirty-one species of aquatic beetles, representing the families Dytiscidae, Hydrophilidae, Haliplidae, and Gyrinidae, were collected in the Miller Blue Hole, a large spring, between October 21, 1967 and January 27, 1969. The numbers of each species collected are tabulated by monthly intervals. Some of the species present in this unusual habitat are rare; *Tropisternus columbianus* is apparently recorded from Ohio for the first time.

519. Menon, A. S., W. A. Glooschenko and N. M. Burns. 1972. Bacteria-phytoplankton relationships in Lake Erie. Internat. Assoc. Great Lakes Res. Proc. 15th Conf. on Great Lakes Res. pp. 94-101.

Bacterial densities in Lake Erie exhibited two maxima, in August and late October and two minima, in late September and early December. Highest bacterial densities were found in the eutrophic Western Basin and the least in the mesotrophic Eastern Basin. Vertical distribution of bacteria was fairly uniform when the water was unstratified. During summer stratification, hypolimnion bacterial densities increased steadily and reached maximum levels in late August, coinciding with the period of maximum phytoplankton development. A significant positive correlation was found between bacteria, chlorophyll *a* and particulate organic carbon in the hypolimnion during this period.

Complex bacteria-phytoplankton relationships existed in Lake Erie, of which four types are described in this study. Generally, bacteria appeared to be dependent on the nutrients derived from the excretion and degradation of phytoplankton.

520. Menon, A. S., C. V. Marion and A. N. Miller. 1971. Microbiological studies of oxygen depletion and nutrient regeneration processes in the Lake Erie Central Basin. Internat. Assoc. Great Lakes Res.

Proc. 14th Conf. on Great Lakes Res. pp. 768-780.

The significance of bacterial activity in the overall processes of oxygen depletion and nutrient regeneration in the Central Basin of Lake Erie was assessed. Most intensive bacterial activity occurred at the sediment-water interface. Bacterial decomposition of organic matter accumulating at the interface resulted in the formation of reduced products of low molecular weight and depletion of oxygen in the hypolimnion. These compounds were subsequently oxidized by chemoautotrophic bacteria with further loss of O_2. Reducing conditions on the bottom adversely affected nitrifying bacterial densities. However, actively photosynthesizing algae freshly deposited on the bottom stimulated multiplication of nitrifying bacteria and nitrification.

Large bacterial populations were absent in the thermocline, suggesting that this zone was not a site for intensive bacterial activity. Quantitative analysis indicated that the high bacterial densities in the hypolimnion, especially at the sediment-water interface, respiring at the rate of 2.4×10^{-11} mg O_2/cell/hr could account for oxygen depletion in the lake.

521. Menon, A. S., C. V. Marion and A. N. Miller. 1972. Microbiological studies related to oxygen depletion and nutrient regeneration processes in the Lake Erie Central Basin. In: Noel M. Burns and Curtis Ross (Eds.), Project Hypo: An Intensive Study of the Lake Erie Central Basin Hypolimnion and Related Surface Water Phenomena. U.S.E.P.A. Washington, D.C. Tech. Rept. TS-05-71-208-24. pp. 71-84.

See abstract 520.

Merkle, Henry K. - See: George D. Simpson, No. 704.

522. Metcalf, I. S. H. 1942. The attraction of fishes by disposal plant effluent in a fresh water lake. Ohio J. Sci. 62(5):191-197.

The apparent attraction of white bass by the disposal plant effluent emptied into Lake Erie by the City of Lakewood, Ohio is investigated. A comparison of the plankton population in the region of the effluent outlet is made with that at a point in the open lake which is believed to be unpolluted by effluent. Four genera of algae and three groups of zooplankton organisms are used as bases for this comparison.

523. Meyer, Bernard S. 1939. The daily cycle of apparent photosynthesis in a submerged aquatic. Am. J. Bot. 26(9):755-760.

An apparatus is described with which it is possible to make consecutive hourly determinations of the rate of apparent photosynthesis in a submerged aquatic without disturbing or handling the plant in any way during the course of an experiment. On clear days in late July and in August with the temperature of the water in which the plant is immersed showing only a slight daily variation, the rate of apparent photosynthesis in apical shoots of *Ceratophyllum demersum* L. shows a rapid rise during the morning hours to a peak value which is attained between 10 a.m. and 12 noon, after which it shows a consistent decline. (BU)

524. Meyer, Bernard S., Frank H. Bell, L. C. Thompson and Edythe E. Clay. 1943. Effect of depth of immersion on apparent photosynthesis in submerged vascular aquatics. Ecology. 24(3):393-399.

A study has been made of the relative rates of apparent photosynthesis in five species of vascular plants when immersed at a series of depths ranging to ten meters in Lake Erie near Put-in-Bay, Ohio. In all five species the rate of apparent photosynthesis decreases less rapidly with depth of immersion than does light intensity.

525. Meyer, Bernard S. and Albert C. Heritage. 1941. Effect of turbidity and depth of immersion on apparent photosynthesis in *Ceratophyllum demersum*. Ecology. 22(1):17-22.

Marked changes in turbidity are characteristic of Lake Erie waters in the vicinity of the Bass Islands. This investigation studies the influences of the turbidity factor upon the rate of apparent photosynthesis in a submerged aquatic plant - the hornwort, *Ceratophyllum demersum* Linn. (BU)

526. Meyer, Marvin C. 1946. Further notes on the leeches (Piscicolidae) living on fresh-water fishes of North America. Trans. Am. Micro. Soc. 65(3): 237-249.

A study of fresh-water fish leeches collected from Lake Erie as well as other areas. Results yielded species previously unreported for these areas. A description of the North

American fresh-water leeches, as based on external morphological features, together with a key, is included. (BU)

527. Michalski, M. F. P. 1968. Phytoplankton levels in Canadian near-shore waters of the lower Great Lakes. Internat. Assoc. Great Lakes Res. Proc. 11th Conf. on Great Lakes Res. pp. 85-95.

In Lake Erie, average standing crops of phytoplankton decreased in order, from the Western to the Central, to the Eastern Basin. At Kingsville, the levels and duration of spring and fall maxima reflected the eutrophic condition of the Western Basin of Lake Erie. The major forms in each basin are listed.

528. Michalski, M. F. P. 1972. Phytoplankton conditions in the Nanticoke area of Lake Erie, 1969-1971. Ministry Env. Toronto, Ont. 10 p.

Changes in abundance and seasonal composition of standing stocks of phytoplankton were evaluated at eight fixed stations in 1969 and 1970 and at nine stations in 1971. Water clarity and chlorophyll levels were also assessed.

529. Michigan Department of Natural Resources. 1973. Flooding problems assocated with current high levels of the Great Lakes. Mich. Dept. Nat. Resources. Water Dev. Services Div. Lansing, Mich. 47 p.

Concern is expressed involving the impact of flooding on the biological resources adjacent to the Great Lakes. Loss of habitat and the corresponding repercussions on fish and wildlife populations that use these areas for breeding, feeding and cover are mentioned.

530. Michigan Water Resources Commission. 1970. Great Lakes algae monitoring program - 1969. Mich. Dept. Nat. Resources. Lansing, Mich. 16 p.

This report describes a monitoring program initiated by the Michigan Water Resources Commission to provide qualitative and quantitative algal data for Michigan's Great Lakes coastline surface waters. Samples were collected during the summer recreation and vacation season (June to September) of 1969, in conjunction with an existing program for monitoring the bacterial quality of Michigan's Great Lakes beaches.

There were three major objectives of this program: first, to acquire background data on the quantity and quality of algae in Michigan's Great Lakes coastline surface waters; second, to use algae as indicators of different water quality along the Great Lakes near-shore waters; and third, to provide background data on algal communities (density and type) in the vicinity of proposed large thermal discharges by power plants. These plants will be located along southern Lake Michigan and Western Lake Erie.

531. Miles, J. R. W. and C. R. Harris. 1971. Insecticide residues in a stream and a controlled drainage system in agricultural areas of Southwestern Ontario, 1970. Pestic. Monit. J. 5(3):289-294.

Big Creek, flowing into Lake Erie near Long Point, Ontario, and a drainage system which enters Lake Erie near Eriea, Ontario were monitored for insecticide residues during 1970. Water, mud and fish samples were analyzed. While the residue concentrations of the water were extremely low, the concentrations in the mud and fish were between 820 and 80,000 times that found in the water.

Miller, A. N. - See: A. S. Menon, et al, No. 520, 521.

532. Miller, Ethel Melsheimer. 1932. Bibliography of Ohio botany. Ohio Biol. Surv. Bull. 27. 5(4):281-376.

A bibliography of the flora of Ohio including those areas bordering on Lake Erie and its tributaries, from 1755 to 1931. (SM)

533. Miller, Robert Rush. 1957. Origin and dispersal of the alewife, Alosa pseudoharengus, and the gizzard shad, Dorosoma cepedianum, in the Great Lakes. Trans. Am. Fish. Soc. 86:97-111.

Three species of the herring family, Clupeidae, have been reported from the Great Lakes drainage, the American shad (Alosa sapidissima), the gizzard shad (Dorosoma cepedianum), and the alewife (Alosa pseudoharengus). A comparison of the distinctive morphological characteristics of each is made. In addition the chronological records of appearance of the latter two species are discussed. (BU)

Mitchell, Harold D. - See: Clark S. Beardslee, No. 53.

534. Mitchell, Harold D. and Robert F. Andrle. 1970. Birds of the Niagara Frontier region - supplement. Bull. Buffalo Soc. Nat. Sci. Buffalo, N.Y. Bull. 22. 10 p.

A supplement to Beardslee and Mitchell 1965, "Birds of the Niagara Frontier Region." Ten new species and subspecies and two forms which were on the "Hypothetical List" in the 1965 publication are added to the earlier work. Records of significant sightings since 1965 are included. (SM)

535. Moffett, James W. 1954. A research program. Chief of Great Lakes Fishery Investigations outlines program for Lake Erie. Fisherman. 22(1):7, 11, 12, 14.

An annotated outline of certain fundamental problems which must be considered in the development of an international fishery research program for Lake Erie.

536. Moore, Emmeline. 1929. Introduction - A biological survey of the Erie-Niagara system. In: A Biological Survey of the Erie-Niagara System. N.Y. Dept. Cons. Albany, N.Y. Suppl. 18th Ann. Rept. (1928). pp. 9-18.

A general introduction to the survey of the Erie-Niagara system conducted by the New York Conservation Department in 1928. Reviewed are such topics as: area of survey, authorization, the watershed as a unit, program of the survey, organization of staff, conditions of pollution, and results of the survey.

Moore, James E. - See: Walter A. Glooschenko, No. 285, 286.

537. Morgan, James J. (Ed.). Lake Erie dying but not dead. Env. Sci. Tech. 1(3):212-218.

This reference is a feature article on changes taking place in Lake Erie. Included is a discussion of growth of aquatic organisms brought about by siltation and temperature changes. The changes in Lake Erie fish population in the past fifty years are graphed and the disappearance of the blue pike, whitefish, cisco and sauger commented upon. Less valuable species are becoming dominant. A suggested area for study is the role of bacteria as the causative agent in producing chemical changes in both overlying water and in sediment. (BECPL)

538. Morse, Withrow. 1930. The chemical constitution of Pectinatella. Science. 71(1836):265.

Pectinatella from the area of Put-in-Bay was used to study synthesis of protein. (SM)

539. Moseley, Edwin L. 1899. Sandusky flora. A catalogue of the flowering plants and ferns growing without cultivation in Erie County, Ohio and the peninsula and islands of Ottawa County. Ohio State Acad. Sci. Spec. Paper 6. 162 p.

Facts bearing on the origin of the island flora may be summarized as follows: within the present century the waters of Lake Erie and of bays and marshes connected with it have encroached upon the land in the vicinity of Sandusky, covering many hundreds of acres of what was at the time of the first surveys solid ground. The flora of the islands is different from what we should expect to find, if all the species growing there had been transported across the water. It is probable then that many species have been on the islands since a time when these formed part of the mainland. The publication contains a complete catalogue of the flora of the region with comment on the location of the species. (SM)

540. Moseley, Edwin L. 1900. Occasional abundance of certain birds on or near Lake Erie. Ohio Acad. Sci. 8th Ann. Rept. 1899:12-15.

A report of several instances in which large flocks of birds have been seen on or near Lake Erie. Species seen in large numbers include; swans, Canada geese, yellow-bellied sapsuckers, eagles, and swallows. Up to 200 pin-tail ducks are said to have been caught in gill nets (set in 14-19 fathoms of water) and drowned near Erie, Pennsylvania. (SM)

541. Moseley, Edwin L. 1901. Old-squaw ducks (not "pintails") caught in deep water fish nets. Ohio Acad. Sci. 9th Ann. Rept. 1900:19-20.

A note reporting the capture of large numbers of old-squaw ducks caught in nets, set in water from 80 to 100 feet deep, seventeen miles northeast of Erie, Pennsylvania. The incident took place in November of 1900. Several fishing tugs were reported to have brought in from 500 to 550 ducks. (SM)

542. Moseley, Edwin L. 1904. Formation of Sandusky Bay and Cedar Point. Proc. Ohio State Acad. Sci. 13th Ann. Rept. 4(5):179-238.

This report contains a discussion of the changing conditions in Sandusky Bay and Cedar Point. Submerged forests, formation of ridges and other changing conditions are mentioned. The effects of high water and the gradual shifting of shorelines and changes in plant communities are discussed. The gradual enlargement of Sandusky Bay, and the disappearance of Cedar Point are predicted by the author. (SM)

543. Moseley, Edwin L. 1928. Flora of the oak openings west of Toledo. Proc. Ohio Acad. Sci. Spec. Paper 20. 8(3):79-134.

A description of flora that grows in the sandy soil near Toledo that was once covered by Lake Warren, the glacial lake which stood about 100 feet higher than Lake Erie now stands, and extended over a much greater area than Lake Erie now covers. A catalogue of the flora is included. In addition, soil analysis was done to determine the most suitable crops for the area. (SM)

544. Moseley, Edwin L. 1930. Fluctuations of bird life with changing water levels. Wilson Bull. 42(3): 191-193.

A brief discussion of the advantages which high water on Lake Erie affords to bird life by increasing the food supply in marshes and offering increased protection from predators. Increase in numbers of bitterns, ducks and grebes was noted. (SM)

545. Moseley, Edwin L. 1936. Blue heron colonies in northern Ohio. Wilson Bull. 48(1):1-13.

This report contains a description of the blue heron's behavior with regard to nesting and the feeding of a variety of fish to the young. It reviews the known heron sites in northern Ohio and discusses factors which influence the population changes. (SM)

546. Muenscher, W. C. 1929. Vegetation of the Niagara River and the eastern end of Lake Erie. In: A Biological Survey of the Erie-Niagara System. N.Y. Cons. Dept. Albany, N.Y. Suppl. 18th Ann. Rept. (1928). pp. 189-197.

A brief survey of the distribution and composition of the vegetation in the Niagara River and the eastern end of Lake Erie was made between August 14 and August 30, 1928. More specifically, this report covers observations made on the American side of the Niagara River, including the shores of Grand Island and several small islands near it, as well as the shallow channels between the islands, and from Buffalo harbor along the south shore of Lake Erie to the Pennsylvania State boundary.

The discussion of the vegetation of the region under consideration may for convenience be taken up under the following areas: (1) the south shore of Lake Erie; (2) Buffalo harbor; (3) the upper Niagara River; and (4) the lower Niagara River.

Munawar, Mohiuddin - See: Walter A. Glooschenko, et al, No. 285.

Myser, W. C. - See: W. L. Giltz, No. 283.

547. Nash, Carroll Blue. 1950. Associations between fish species in tributaries and shore waters of Western Lake Erie. Ecology. 31(4):561-566.

Qualitative fish species collections were made at 29 sites in Western Lake Erie and its tributaries. The sites represented three communities characterized by the type of bottom of the water primarily inhabited. These communities were: the primarily hard-bottom stream communities, the primarily mud-bottom water communities, and the primarily hard-bottom lake-shore communities. While many species occur in two or all three of the habitats, nearly every species has its highest degrees of association only with species that have a primary habitat preference similar to its own. (BU)

548. Neil, John H. and Glenn E. Owen. 1964. Distribution, environmental requirements and significance of Cladophora in the Great Lakes. Univ. Mich. Great Lakes Res. Div. Proc. 7th Conf on Great Lakes Res. Pub. 11:113-121.

Excessive growths of Cladophora sp. along certain sections of the Great Lakes shoreline create serious nuisance conditions which affect the use of water for recreational, industrial and municipal purposes. Information on the ecology of this algae was collected as part of a study directed towards the development of control measures. The presence of Cladophora is dependent on a suitable substrate for attachment, water movement, adequate light, and nutrients in excess of those

normally available in the waters of the upper Great Lakes. Lakes Ontario and Erie have sufficient inherent fertility to support marginal growths, but where local nutrient sources are available, production increases. Phosphorus applied to a location providing suitable physical conditions but devoid of Cladophora resulted in the establishment of a sizeable area of growth. The results of attempts at control are also discussed.

549. Nepszy, Stephen J. and A. O. Dechtiar. 1972. Occurrence of Glugea hertwigi in Lake Erie rainbow smelt (Osmerus mordax) and associated mortality of adult smelt. J. Fish. Res. Bd. Can. 29(11): 1639-1641.

The occurrence of cysts of Glugea hertwigi, a microsporidian parasite, in Lake Erie rainbow smelt (Osmerus mordax) has been monitored since 1960 when it was first recorded. Annual sampling has shown that an increasing proportion (up to 87.5% in 1971) of the smelt population has been infected. An unusually severe mortality among adult smelt occurred during early May, 1971, in Western and West Central Lake Erie. Sampling of dead and obviously stressed smelt revealed that 97.3% of the males and 76.7% of the females were heavily loaded with cysts in the intestines and gonads, respectively. It is suggested that the parasite load contributed to the unusual severity of the normal post spawning mortality. (SM)

Newman, E. S. - See: R. A. O'Reilly, et al, No. 607.

550. New York State Conservation Commission. 1919. 8th annual report. Div. Fish and Game. Bur. Inland Fish. Albany, N.Y. Legislative Document 54. pp. 62-65.

Included is a brief note on the quantity of lake herring taken from New York waters of Lake Erie. During the 1917 fishing season approximately 3,400,000 pounds or 1,700 tons of lake herring were taken by commercial fishermen. (BECPL)

551. New York State Conservation Commission. 1920. 9th annual report for the year 1919. Div. Fish and Game. Bur. Inland Fish. Albany, N.Y. Legislative Document 83. pp. 61-67.

During the 1918 fishing season, a total of 3,699,472 pounds of fish were taken from New York waters of Lake Erie. Mention

is made that the ciscoes or green-backed herring taken from Lakes Erie and Ontario combined amounted to 3,774,295 pounds. (BECPL)

552. New York State Conservation Commission. 1921. 10th annual report for the year 1920. Div. Fish and Game. Bur. Inland Fish. Albany, N.Y. Legislative Document 95. pp. 101-105.

During 1919 Lake Erie produced more fish for market than all other fresh waters of the state combined. A total of 4,335,936 pounds with a value of $288,826 were produced. (BECPL)

553. New York State Conservation Commission. 1924. 13th annual report for the year 1923. Div. Fish and Game. Bur. Inland Fish. Albany, N.Y. Legislative Document 30. pp. 93-97.

During 1922 Lake Erie yielded the greatest amount of fish taken from any body of water in the state. Fishermen reported they had taken a total of 4,968,024 pounds. Information regarding the relative abundance of the catch per species is tabulated. (BECPL)

554. New York State Conservation Commission. 1925. 14th annual report for the year 1924. Div. Fish and Game. Bur. Inland Fish. Albany, N.Y. Legislative Document 29. pp. 52-63.

During the 1923 fishing season, a total of 7,164,782 pounds with a value of $462,442 were taken from New York waters of Lake Erie. Information regarding the relative abundance of the catch per species is tabulated. (BECPL)

555. New York State Conservation Commission. 1926. 15th annual report for the year 1925. Div. Fish and Game. Bur. Inland Fish. Albany, N.Y. Legislative Document 28. pp. 53-63.

During the 1924 fishing season, a total of 8,324,433 pounds with a value of $390,372 were taken from New York waters of Lake Erie. Information regarding the relative abundance of the catch per species is tabulated. (BECPL)

556. New York State Conservation Commission. 1926. 15th annual report for the year 1925. Div. Fish and Game. Bur. Inland Fish. Albany, N.Y. Legislative Document 28. pp. 53-60.

A report on the 1924 commercial catch of fish from the waters of New York. Lake Erie is discussed concerning the increased cisco fishery due to the operations of the hatchery at Dunkirk, New York. The shortage of cisco spawn needed to keep the hatchery operating efficiently is discussed. Included is a poundage report for each species caught in the lake. (CB)

557. New York State Conservation Commission. 1927.
16th annual report for the year 1926. Div. Fish and Game. Bur. Inland Fish. Albany, N.Y. Legislative Document 29. pp. 90-99.

During the 1925 fishing season, a total of 4,011,681 pounds with a value of $277,068 were taken from New York waters of Lake Erie. Information regarding the relative abundance of the catch per species is tabulated. (BECPL)

558. New York State Conservation Department. 1928.
17th annual report for the year 1927. Div. Fish and Game. Bur. Inland Fish. Albany, N.Y. Legislative Document 38. pp 299-312.

During the 1926 fishing season, a total of 2,639,232 pounds with a value of $162,994 were taken from New York waters of Lake Erie. Information regarding the relative abundance of the catch per species is tabulated. (BECPL)

559. New York State Conservation Department. 1929.
18th annual report for the year 1928. Div. Fish and Game. Bur. Inland Fish. Albany, N.Y. Legislative Document 38. pp. 265-278.

During the 1927 fishing season, a total of 1,320,151 pounds with a value of $150,950 were taken from New York waters of Lake Erie. Information regarding the relative abundance of the catch per species is tabulated. (BECPL)

560. New York State Conservation Department. 1930.
19th annual report for the year 1929. Div. Fish and Game. Bur. Inland Fish. Albany, N.Y. Legislative Document 38. pp. 257-269.

During the 1928 fishing season, a total of 1,046,715 pounds with a value of $142,390 were taken from New York waters of Lake Erie. Information regarding the relative abundance of the catch per species is tabulated. (BECPL)

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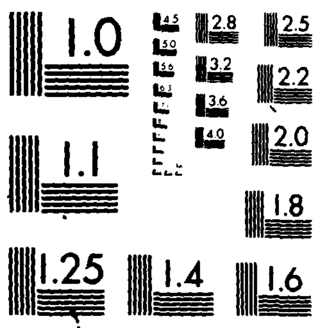

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561. New York State Conservation Department. 1931. 20th annual report for the year 1930. Div. Fish and Game. Bur. Inland Fish. Albany, N.Y. Legislative Document 38. pp. 275-282.

During the 1929 fishing season, a total of 691,424 pounds with a value of $91,868 were taken from New York waters of Lake Erie. Information regarding the relative abundance of the catch per species is tabulated. (BECPL)

562. New York State Conservation Department. 1932. 21st annual report for the year 1931. Div. Fish and Game. Bur. Inland Fish. Albany, N.Y. Legislative Document 38. pp. 251-262.

During the 1930 fishing season, a total of 966,385 pounds with a value of $93,738 were taken from New York waters of Lake Erie. Information regarding the relative abundance of the catch per species is tabulated. (BECPL)

563. New York State Conservation Department. 1933. 22nd annual report for the year 1932. Div. Fish and Game. Bur. Inland Fish. Albany, N.Y. Legislative Document 38. pp. 256-277.

During the 1931 fishing season, a total of 1,306,733 pounds with a value of $86,211 were taken from New York waters of Lake Erie. Information regarding the relative abundance of the catch per species is tabulated. (BECPL)

564. New York State Conservation Department. 1935. 24th annual report for the year 1934. Div. Fish and Game. Bur. Inland Fish. Albany, N.Y. Legislative Document 38. pp. 246-262.

During the 1933 fishing season, a total of 522,415 pounds with a value of $50,430 were taken from New York waters of Lake Erie. Information regarding the relative abundance of the catch per species is tabulated. (BECPL)

565. New York State Conservation Department. 1936. 25th annual report for the year 1935. Div. Fish and Game. Bur. Inland Fish. Albany, N.Y. Legislative Document 38. pp. 305-319.

During the 1934 fishing season, a total of 573,488 pounds with a value of $46,033 were taken from New York waters of Lake Erie. Information regarding the relative abundance of the catch per species is tabulated. (BECPL)

566. New York State Conservation Department. 1937. 26th annual report for the year 1936. Div. Fish and Game. Bur. Inland Fish. Albany, N.Y. Legislative Document 38. pp. 278-288.

During the 1935 fishing season, a total of 568,012 pounds with a value of $34,969 were taken from New York waters of Lake Erie. Information regarding the relative abundance of the catch per species is tabulated. (BECPL)

567. New York State Conservation Department. 1938. 27th annual report for the year 1937. Div. Fish and Game. Bur. Inland Fish. Albany, N.Y. Legislative Document 38. pp. 253-261.

During the 1936 fishing season, a total of 684,436 pounds with a value of $39,056 were taken from New York waters of Lake Erie. Information regarding the relative abundance of the catch per species is tabulated. (BECPL)

568. New York State Conservation Department. 1939. 28th annual report for the year 1938. Div. Fish and Game. Bur. Inland Fish. Albany, N.Y. Legislative Document 38. pp. 229-239.

During the 1937 fishing season, a total of 2,055,585 pounds with a value of $130,042 were taken from New York waters of Lake Erie. Information regarding the relative abundance of the catch per species is tabulated. (BECPL)

569. New York State Conservation Department. 1940. 29th annual report for the year 1939. Div. Fish and Game. Bur. Inland Fish. Albany, N.Y. Legislative Document 38. pp. 222-229.

During the 1938 fishing season, a total of 1,558,495 pounds with a value of $154,022 were taken from New York waters of Lake Erie. Information regarding the relative abundance of the catch per species is tabulated. (BECPL)

570. New York State Conservation Department. 1941. 30th annual report for the year 1940. Div. Fish and Game. Bur. Inland Fish. Albany, N.Y. Legislative Document 37. pp. 205-212.

During the 1939 fishing season, a total of 1,146,168 pounds with a value of $147,290 were taken from New York waters of Lake Erie. Information regarding the relative abundance of the catch per species is tabulated. (BECPL)

571. New York State Conservation Department. 1942. 31st annual report for the year 1941. Div. Fish and Game. Bur. Inland Fish. Albany, N.Y. Legislative Document 32. pp. 198-209.

During the 1940 fishing season, a total of 599,588 pounds with a value of $79,736 were taken from New York waters of Lake Erie. Information regarding the relative abundance of the catch per species is tabulated. (BECPL)

572. New York State Conservation Department. 1943. 32nd annual report for the year 1942. Div. Fish and Game. Bur. Inland Fish. Albany, N.Y. Legislative Document 27. pp. 173-187.

During the 1941 fishing season, a total of 498,763 pounds with a value of $73,574 were taken from New York waters of Lake Erie. Information regarding the relative abundance of the catch per species is tabulated. (BECPL)

573. New York State Conservation Department. 1944. 33rd annual report for the year 1943. Div. Fish and Game. Bur. Inland Fish. Albany, N.Y. Legislative Document 25. pp. 127-142.

During the 1942 fishing season, a total of 570,186 pounds with a value of $92,744 were taken from New York waters of Lake Erie. Information regarding the relative abundance of the catch per species is tabulated. (BECPL)

574. New York State Conservation Department. 1946. 34th-35th annual report for the years 1944-1945. Div. Fish and Game. Bur. Inland Fish. Albany, N.Y. Legislative Document 61. pp. 159-164.

During the 1943 fishing season, a total of 1,006,470 pounds with a value of $143,151 were taken from New York waters of Lake Erie. During the 1944 fishing season, a total of 1,623,659 pounds with a value of $153,164 were taken from New York waters of Lake Erie. Information regarding the relative abundance of the catch per species is tabulated. (BECPL)

575. New York State Conservation Department. 1947. 36th annual report for the year 1946. Div. Fish and Game. Bur. Inland Fish. Albany, N.Y. Legislative Document 85. pp. 140-155.

During the 1945 fishing season, a total of 1,788,408 pounds with a value of $280,643 were taken from New York waters of Lake Erie. Information regarding the relative abundance of the catch per species is tabulated. (BECPL)

576. New York State Conservation Department. 1948. 37th annual report for the year 1947. Div. Fish and Game. Bur. Inland Fish. Albany, N.Y. Legislative Document 62. pp. 134-140.

During the 1946 fishing season, a total of 2,256,426 pounds with a value of $280,324 were taken from New York waters of Lake Erie. Information regarding the relative abundance of the catch per species is tabulated. (BECPL)

577. New York State Conservation Department. 1950. 39th annual report for the year 1949. Div. Fish and Game. Bur. Inland Fish. Albany, N.Y. Legislative Document 76. pp. 146-164.

During the 1948 fishing season, a total of 923,402 pounds with a value of $164,231 were taken from New York waters of Lake Erie. Information regarding the relative abundance of the catch per species is tabulated. (BECPL)

578. New York State Conservation Department. 1951. 40th annual report for the year 1950. Div. Fish and Game. Bur. Inland Fish. Albany, N.Y. Legislative Document 48. pp. 156-184.

During the 1949 fishing season, a total of 1,953,733 pounds with a value of $349,637 were taken from New York waters of Lake Erie. Information regarding the relative abundance of the catch per species is tabulated. (BECPL)

579. New York State Conservation Department. 1952. 41st annual report for the year 1951. Div. Fish and Game. Bur. Inland Fish. Albany, N.Y. Legislative Document 78. pp. 156-189.

During the 1950 fishing season, a total of 385,091 pounds with a value of $78,552 were taken from New York waters of Lake Erie. Information regarding the relative abundance of the catch per species is tabulated. (BECPL)

580. New York State Conservation Department. 1953. 42nd annual report for the year 1952. Div. Fish and Game. Bur. Inland Fish. Albany, N.Y. Legislative Document 27. pp. 158-208.

During the 1951 fishing season, a total of 302,068 pounds with a value of $90,968 were taken from New York waters of Lake Erie. Information regarding the relative abundance of the catch per species is tabulated. (BECPL)

581. New York State Conservation Department. 1954. 43rd annual report for the year 1953. Div. Fish and Game. Bur. Fish. Albany, N.Y. Legislative Document 47. pp. 127-202.

During the 1952 fishing season, a total of 599,028 pounds with a value of $169,727 were taken from New York waters of Lake Erie. Information regarding the relative abundance of the catch per species is tabulated. (BECPL)

582. New York State Conservation Department. 1955. 44th annual report for the year 1954. Div. Fish and Game. Bur. Fish. Albany, N.Y. Legislative Document 47. pp. 125-173.

During the 1953 fishing season, a total of 693,733 pounds with a value of $197,609 were taken from New York waters of Lake Erie. Information regarding the relative abundance of the catch per species is tabulated. (BECPL)

583. New York State Conservation Department. 1956. 45th annual report for the year 1955. Div. Fish and Game. Bur. Fish. Albany, N.Y. Legislative Document 88. pp. 100-130.

During the 1954 fishing season, a total of 885,101 pounds with a value of $142,631 were taken from New York waters of Lake Erie. This is the first year since catch reports have been available that no cisco catch was reported. The decrease in value despite the increase in number of pounds as compared with the previous year was caused by smaller catches of some of the more valuable species, especially whitefish and ciscoes. While these were more than replaced, quantitatively, by yellow perch, white bass, sheepshead and other species, the market value of these was much lower. (BECPL)

584. New York State Conservation Department. 1957. 46th annual report for the year 1956. Div. Fish and Game. Bur. Fish. Albany, N.Y. Legislative Document 114. pp. 100-130.

During the 1955 fishing season, a total of 1,846,638 pounds were taken from New York waters of Lake Erie. The notable gain as compared with 1954 was due to the major increase in the take of blue pike. (BECPL)

585. New York State Conservation Department. 1958. 47th annual report for the year 1957. Div. Fish and Game. Bur. Fish. Albany, N.Y. Legislative Document 110. pp. 102-134.

During the 1956 fishing season, a total of 1,164,349 pounds with a value of $177,867 were taken from New York waters of Lake Erie. Information regarding the relative abundance of the catch per species is tabulated. (BECPL)

586. New York State Conservation Department. 1959. 48th annual report for the year 1958. Div. Fish and Game. Bur. Fish. Albany, N.Y. Legislative Document 109. pp. 94-127.

During the 1957 fishing season, a total of 695,429 pounds with a value of $171,773 were taken from New York waters of Lake Erie. Information regarding the relative abundance of the catch per species is tabulated. (BECPL)

587. New York State Conservation Department. 1962. 51st annual report for the year 1961. Div. Fish and Game. Bur. Fish. Albany, N.Y. Legislative Document 105. pp. 95-113.

During the 1960 fishing season, a total of 331,675 pounds with a value of $49,348 were taken from New York waters of Lake Erie. Information regarding the relative abundance of the catch per species is tabulated. (BECPL)

588. New York State Conservation Department. 1963. 52nd annual report for the year 1962. Div. Fish and Game. Bur. Fish. Albany, N.Y. Legislative Document 106. pp. 99-115.

During the 1961 fishing season, a total of 545,484 pounds with a value of $75,906 were taken from New York waters of Lake Erie. Information regarding the relative abundance of the catch per species is tabulated. (BECPL)

589. New York State Conservation Department. 1964. 53rd annual report for the year 1963. Div. Fish and Game. Bur. Fish. Albany, N.Y. Legislative Document 101. pp. 97-114.

During the 1962 fishing season, a total of 447,269 pounds with a value of $60,137 were taken from New York waters of Lake Erie. Information regarding the relative abundance of the catch per species is tabulated. (BECPL)

590. New York State Conservation Department. 1965. 54th annual report for the year 1964. Div. Fish and Game. Bur. Fish. Albany, N.Y. Legislative Document 98. pp. 92-105.

During the 1963 fishing season, a total of 269,142 pounds with a value of $49,602 were taken from New York waters of Lake Erie. Information regarding the relative abundance of the catch per species is tabulated. (BECPL)

591. New York State Conservation Department. 1966. 55th annual report for the year 1965. Div. Fish and Game. Bur. Fish. Albany, N.Y. Legislative Document 98. pp. 86-93.

During the 1964 fishing season, a total of 179,511 pounds with a value of $45,994 were taken from New York waters of Lake Erie. Information regarding the relative abundance of the catch per species is tabulated. (BECPL)

592. New York State Department of Environmental Conservation. 1973. Environmental Plan for New York State. Preliminary Edition. N.Y. State Dept. Env. Cons. Albany, N.Y. 91 p.

A report on the environmental effects of growth and development in New York State with emphasis on choices which must be made and their probable effects. Sections on land, water, air, fish and wildlife, and energy are included. Mention is made of Lake Erie as a municipal water supply and a commercial fishery.

593. New York State Department of Health. 1957. Cattaraugus Creek drainage basin. N.Y. Dept. Health. Albany, N.Y. Lake Erie-Niagara River Drainage Basin Ser. Rept. 4. 85 p.

This report gives information concerning the quality and use of water in the Cattaraugus Creek drainage basin. Biological field work was done during the weeks of August 20 and September 9, 1956. Tables are included showing the condition of the water at the time of the survey.

594. New York State Department of Health. 1963. Lake Erie (West End) and tributaries drainage basins in Chautauqua County except Cattaraugus Creek and Silver Creek drainage basins. N.Y. Dept. Health. Albany, N.Y. Lake Erie-Niagara River Drainage Basin Ser. Rept. 6. 115 p.

This report is a study of specific waters prior to the classification and assignment of water quality standards to such waters. The adoption of classifications and assignment of water quality standards depends upon action of the Water Resources Commission following public hearing. Tables are included showing recommended classifications, sampling stations, coliform data and other analytical results.

595. Nickell, Walter P. 1966. Common terns nest on muskrat lodges and floating cattail mats. Wilson Bull. 78(1):123-124.

A brief article concerning the discovery of 35 nests of the common tern, Sterna hirundo, on two floating mats of cattails which had died. The water was five to seven feet deep. Muck and cattail roots held the mats together. Ten nests were found on top of muskrat lodges. (SM)

Nitchals, Ruth. - See: Jessie Finley Klocke, et al, No. 433.
Jessie Finley Klocke, et al, No. 434.

596. Norden, Carroll. 1961. The identification of larval yellow perch, Perca flavescens, and walleye, Stizostedion vitreum. Copeia. 1961(3):282-288.

This study used largely specimens gathered from the Great Lakes with collection from Lake Erie being done in 1957, 1958, and 1959. Some walleye larvae were from the hatchery stock at Put-in-Bay, Ohio. Comparisons were made between the larvae of the yellow perch and the walleye with regard to the morphometric and meristic characteristics. (SM)

597. Normandin, Robert F. and Clarence E. Taft. 1959. A new species of Basicladia from the snail Viviparus malleatus Reeve. Ohio J. Sci. 59(1):58-62.

In June 1956 a specimen of the snail Viviparus malleatus Reeve was obtained from a pond on South Bass Island, Lake Erie. An alga growing on the snail shell was identified as the genus Basicladia previously recorded as only being present on

the carapace of turtles. Through culturing it was found that the alga was unique and specific to the genus both in species characteristics and habitat. Therefore it was described as a new species, *Basicladia vivipara*. (BU)

598. Northington, Charles W. 1965. Is Lake Erie dying? Sierra Club Bull. 50(9):3-7.

A popular article outlining the known pollution problems of the tributaries and shoreline of the United States section of Lake Erie. Conditions from the Western Basin to the Eastern Basin are described and remedial measures suggested. (SM)

Oeming, L. F. - See: H. H. Black, No. 71.

599. Offcutt, Tom. 1967. The Black Swamp of Ohio. Explorer. Cleveland, Ohio. 9(2):21-23.

A brief history of the Black Swamp region of Western Ohio which was drained in the late 19th century. Emphasis is placed on the agricultural use of the region. (SM)

600. Oglesby, Ray T. 1970. Lakes which produce too much. N.Y. State Dept. Env. Cons. Albany, N.Y. Conservationist. 24(6):18-21.

A general discussion of the causes, symptoms, and effects of cultural eutrophication of lakes. The increase in vegetation is associated with (1) flood, (2) decreased visibility, and (3) the amount of dissolved oxygen. The course which must be followed to slow the eutrophication process is outlined. Lake Erie is mentioned as a nationally known example of a lake with serious eutrophication problems. (SM)

601. Ohio Department of Natural Resources. 1953. Lake Erie Pollution Survey - Final Report. Ohio Dept. Nat. Resources. Columbus, Ohio. 201 p.

This publication is a comprehensive evaluation of the condition of Lake Erie and its Ohio tributaries. Bacterial and sanitary analysis is included. The following biological studies are reported: the suspended silt in the western waters of Lake Erie in the spring of 1951; study of the distribution of phosphorus in Western Lake Erie and its utilization by natural phytoplankton populations; the presence of toxic materials at the mouth of Ohio streams discharging

into Lake Erie, as indicated by the test organism, *Daphnia magna*; the phytoplankton survey at the mouths of ten Ohio streams entering Lake Erie; survey of the bottom fauna at the mouths of ten Lake Erie south shore rivers; and a report on the Cleveland Harbor industrial pollution survey, including its effect on aquatic life.

602. Ohio Department of Natural Resources. 1974. Division of Geological Survey list of publications. Ohio Dept. Nat. Resources. Div. Geol. Surv. Columbus, Ohio. 38 p.

A list of publications prepared by the Ohio Division of Geological Survey. Included are names of libraries in Ohio which have Geological Survey publications available.

Ohlson, Margaret A. - See: Jessie Finley Klocke, et al, No. 434.

603. Ontario Ministry of Natural Resources. 1972. Ontario commercial fish industry - statistics on landings, 1961-1965. Ont. Ministry Nat. Resources. Div. Fish and Wildlife. Commercial Fish and Fur Branch. Toronto, Ont. 55 p.

This publication is a record of fish landings reported by the commercial fish industry in the Province of Ontario for the years 1961-1965. The information presented came from records submitted by the commercial fish industry. The first table for Lake Erie lists landings by species and average price per pound. The second table for Lake Erie lists landings (in pounds) by species and statistical district.

604. Ontario Ministry of Natural Resources. 1972. Ontario commercial fish industry - statistics on landings, 1966-1970. Ont. Ministry Nat. Resources. Div. Fish and Wildlife. Commercial Fish and Fur Branch. Toronto, Ont. 59 p.

This publication is a record of fish landings reported by the commercial fish industry in the Province of Ontario for the years 1966-1970. The information presented came from records submitted by the commercial fish industry. The first table for Lake Erie lists landings by species and average price per pound. The second table for Lake Erie lists landing (in pounds) by species and statistical district.

605. Ontario Water Resources Commission. 1965. Water quality data 1964-65. Ont. Water Resources Comm. Div. Sanitary Eng. Water Quality Surv. Branch. Toronto, Ont. 1:287 p.

The data presented in this publication is part of a program designed to provide a near continuous record of basic water quality information at specific points on rivers and lakes in Ontario. This initial publication covers heavy water use areas in the southern and eastern parts of the Province. Water samples are collected by means of a waste water sampler which is constructed to permit simultaneous collection of samples for determination of coliform organisms and chemical content.

606. Ontario Water Resources Commission. 1967. Water quality data for Ontario lakes and streams 1966-67. Ont. Water Resources Comm. Div. Sanitary Eng. Water Quality Surv. Branch. Toronto, Ont. 3:373 p.

The data presented in this publication was collected as part of a routine sampling program designed to provide a continuous record of water quality information at specific points on rivers and inland lakes in Ontario. Total coliform organisms are enumerated during sample analysis.

607. O'Reilly, R. A., J. F. Akers and E. S. Newman. 1942. Waterfowl populations at Cleveland, Ohio winter of 1939-1940. Auk. 59(4):555-562.

Observation of the waterfowl along fifteen miles of the Lake Erie waterfront between November 5, 1939 and March 31, 1940 revealed both migrant and wintering species of waterfowl. Factors governing the composition of waterfowl flocks off Cleveland is not known. The lack of consequential numbers of dabbling ducks, except the black duck, is apparently due to the absence of suitable feeding grounds. Fish eating ducks seem to maintain their numbers during periods of low temperature and limited feeding grounds. Twenty-three thousand identifications were made during this study. (SM)

608. Orr, Lowell P. 1969. The fishes of the upper Cuyahoga River. In: G. Dennis Cooke (Ed.), The Cuyahoga River Watershed. Kent State Univ. Inst. Limnology. Kent, Ohio. pp.57-86.

A survey of the influence of the chemical and physical characteristics of twelve sampling sites on the Cuyahoga River on the fish of this river. Thirty-one fish species were collected and identified. Little change in the numbers and kinds of fish species in the upper Cuyahoga River has occurred in the last forty years.

609. Ortmann, A. E. 1909. A preliminary list of the Uniondae of Western Pennsylvania, with new localities for species from Eastern Pennsylvania. Annals Carnegie Mus. Pittsburgh, Penn. Article 8. 5(2,3):178-210.

Seventeen forms are listed which were found in the Lake Erie drainage. Collections were primarily from Presque Isle Bay between 1900 and 1908. (SM)

610. Ortmann, A. E. 1924. Distribution features of naiades in tributaries of Lake Erie. Am. Mid. Nat. 9(3):101-117.

A report of the author's distributional records, and previous known distribution, of the Naiad-fauna in Lake Erie tributaries in Northeast Ohio and in Pennsylvania. Nineteen species were found. A theory explaining the distribution is presented. (SM)

611. Ortmann, A. E. and Bryant Walker. 1922. On the nomenclature of certain North American naiades. Univ. Mich. Mus. Zool. Ann Arbor, Mich. Occasional Paper 112. 75 p.

The paper attempts to clarify the classifications of North American naiades by application of the provisions of the International Code of Nomenclature. Attributed to Lake Erie are Amblema plicata (Say), and Ligumia recta (Limarck). Two forms, Pleurobema clava (Lamarck), and Elliptio crassidens (Lamarck) are mentioned as having been incorrectly ascribed to Lake Erie in the past. (SM)

612. Osborn, Herbert. 1901. The lake laboratory. Ohio Nat. 1(6):79-82.

A description of the lake laboratory established by Prof. Kellicott in 1895 at Sandusky, Ohio. (BU)

613. Osborn, Herbert. 1901. Zoological notes. Ohio Nat. 1(6):86-91.

Contains notes on the fauna inhabiting the sand dunes of Cedar Point. (BU)

614. Osborn, Herbert. 1903. Opportunities for faunal studies at the lake laboratory at Sandusky. Ohio Nat. 3(4):363-364.

A discussion of the opportunities and projects available at the lake laboratory for biological students is presented. (BU)

615. Osborn, Herbert. 1930. Bibliography of Ohio zoology. Ohio Biol. Surv. Bull. 23. 4(8):351-410.

A bibliography relating to the fauna of Ohio up to 1930. With very few exceptions all the papers cited are available in the libraries of The Ohio State University. (SM)

616. Osburn, Raymond C. 1901. The fishes of Ohio. Ohio Acad. Sci. Spec. Paper 4. 104 p.

The purpose of this work is to bring together the results of the investigations on the fishes of Ohio. There is a complete listing of the species found and comment on their disribution and records of occurrence. (SM)

617. Osburn, Raymond C., Edward L. Wickliff and Milton B. Trautman. 1930. A revised list of the fishes of Ohio. Ohio J. Sci. 30(3):169-176.

A revision of the original list of the fish of Ohio published in 1901 by Osburn. Several additions and deletions have been made due to more careful taxonomic examination and more extensive collecting. The list now consists of 159 species. (BU)

Osmond, D. S. - See: D. M. Veal, No. 827.

618. Osmond, D. S. 1970. Bottom fauna survey of Long Point Bay in the Nanticoke region 1969. Ministry Env. Biol. Branch. Toronto, Ont. 9 p.

Thirty-one different macroinvertebrate taxa were found at 8 stations in Long Point Bay in 1969. The number of taxa per station ranged from 15 to 20 while the annual average number of organisms per station was 259 (the range being from 53 to 833). Benthic associations varied seasonally both qualitatively and quantitatively. Comparisons were drawn between the species compositions of each station.

Owen, Glen E. - See: John H. Neil, No. 548.

Ownbey, C. R. - See: H. W. Posten, No. 639.
William Q. Kehr, No. 416.

Pakkala, Irene S. - See: Raymond J. Lovett et al, No. 489.

619. Pakkala, Irene S., Merrie N. White, George E. Burdick, Earl J. Harris and Donald J. Lisk. 1972. A survey of the lead content of fish from 49 New York State waters. Pestic. Monit. J. 5(4):348-355.

An analytical survey was made of the total lead content of 419 fish of various species sampled in 1969 from 49 freshwater sites in New York. Most often the lead concentrations ranged from 0.3 to 1.5 ppm. Fish from certain waters including Lake Erie showed higher lead levels more consistently than fish from other waters. No correlation was noted between lead concentrations and the size, species, or sex of fish.

620. Pakkala, Irene S., Merrie N. White, Donald J. Lisk, George E. Burdick and Earl J. Harris. 1972. Arsenic content of fish from New York State waters. N.Y. Fish and Game J. 19(1):13-31.

A survey of 471 fish sampled in 1969 from 49 freshwater sites in New York for total arsenic content is presented. Samples of 12 different species were taken from Eastern Lake Erie. These samples were, for the most part, found to be low in arsenic. In general large fish had higher arsenic concentrations but the concentration did not appear to be cumulative with increasing age.

621. Palmer, Ralph S. 1964. Lake Erie niche for gulls. Nat. History. 73(9):48-51.

An illustrated article about the nesting ground of the ring-billed gull (Larus delawarensis) on Mohawk Island near the Canadian shore in northeastern Lake Erie. This three acre island was a ternery in 1938-41 and approximately 1,000 pairs of common terns nested there. About 1943 a few pairs of ring-billed and herring gulls (Larus argentatus) bred there. As recently as 1950 the terns were the predominant species. In 1952 the ring-bills outnumbered the terns. By 1954 there were about 1,200 ring-billed gull nests, 360 common tern nests and about 36 breeding pairs of herring gulls. (SM)

622. Parker, Carl E. 1970. Mercury - major new environmental problem. N.Y. State Dept. Env. Cons. Albany, N.Y. Conservationist. 25(1):6-9.

This article outlines the factors involved in detecting mercury in the environment. Sources of mercury in the Great Lakes and other surface waters and the setting of allowable standards of mercury content in fish are discussed. Sampling and analysis programs are described along with regulations that are being used to control public exposure to the danger. (SM)

623. Parsons, John W. 1967. Contributions of year-classes of blue pike to the commercial fishery of Lake Erie, 1943-59. J. Fish. Res. Bd. Can. 24(5): 1035-1066.

Age and size compositions of the catch were determined from samples of blue pike taken from commercial landings in the fall, 1943-59. Peaks in production in that period were attributed to a few strong year-classes separated by several weak year-classes. Of the 20 year-classes represented in the samples, those of 1944 and 1949 were by far the strongest; together they contributed 42% (by weight) of the fall blue pike production in 1943-59. The strength of the 1939 and 1940 year-classes was moderate and the 1954 year-class was the last one of any importance. The other 15 year-classes were weak.

The 1957-59 decline in production was accompanied by a marked increase in rate of growth. Blue pike in age-group III weighed nearly eight times more and were 7.7 inches longer in 1959 than in 1951. Landings after 1958 consisted

of only a few large fish. The collapse of the fishery forced blue pike fishermen either to fish for less valuable species or to discontinue operation.

624. Parsons, John W. 1970. Walleye fishery of Lake Erie in 1943-62 with emphasis on contributions of the 1942-61 year-classes. J. Fish. Res. Bd. Can. 27(8):1475-1489.

An account of the changes in the commercial fishery for walleyes (Stizostedion vitreum vitreum) in Lake Erie in 1943-62 with particular reference to the contributions of the 1942-61 year-classes. Certain statistics for the fishery in 1915-62 are included. Descriptions of changes in the fishery are based primarily on analyses of scale samples and lengths and weights of walleyes from fall trapnet landings at Sandusky, Ohio. Changes in the biological conditions and fishing intensity in Western Lake Erie are examined as contributors to the decline in the fishery.

625. Parsons, John W. 1971. Selective food preferences of walleyes of the 1959 year-class in Lake Erie. Trans. Am. Fish. Soc. 100(3):474-485.

Stomachs were examined from 1,473 walleyes (Stizostedion vitreum vitreum) of the 1959 year class collected in Western Lake Erie from June 1959 to October 1960. In the same period, the relative abundance and lengths of potential forage species were determined from trawl catches. The walleyes fed almost entirely on fish. (BU)

626. Parsons, John W. 1972. Life history and production of walleyes of the 1959 year-class in Western Lake Erie, 1959-1962. Trans. Am. Fish. Soc. 101(4): 655-661.

Because of the near collapse of the fishery for walleyes (Stizostedion vitreum vitreum) in Lake Erie in the late 1950's, walleyes of the 1959 year-class were studied to gain a better understanding of the life history of the species and the dynamics of the population. In the summer of 1959 most walleyes of the year-class were in water 10 to 20 feet deep along the south and west shores of the Western Basin. By fall they averaged about 10 inches long and were rather widely distributed throughout the basin. By September 1960 most had reached legal length (then 13 inches in Ohio), and in October they made up nearly the entire commercial walleye production and made the highest monthly contribution during the life of the year-class. Walleyes of the 1959 year-class were cropped

intensively and remained in the fishery for only a relatively short time. About 97% of the females of the year-class were caught before they had spawned once. (BU)

627. Parsons, John W. 1973. History of salmon in the Great Lakes 1850-1970. U.S. Dept. Interior Bur. Sport Fish. and Wildlife. Washington, D. C. Tech. Paper 68. 80 p.

Atlantic, chinook, coho and kokanee salmon have been planted in Lake Erie tributaries in Michigan, Ohio, Pennsylvania and New York between 1873 and 1970.

For the most part, Lake Erie does not provide suitable habitat for salmon. Eutrophication and oxygen depletion in the summer in the deep cold waters of the lake undoubtedly restrict the distribution of the salmon and may reduce the availability of forage. Although rainbow smelt (Osmerus mordax) are abundant in Lake Erie, the relatively slow growth of the salmon suggests that smelt are not abundantly available during the major growing season of the salmon. Becuase of these conditions, plantings of coho and chinook salmon in Lake Erie cannot be expected to be highly successful.

628. Patalas, K. 1972. Crustacean plankton and the eutrophication of St. Lawrence Great Lakes. J. Fish. Res. Bd. Can. 29(10):1451-1462.

The crustaceans found in the summer plankton of Lakes Superior, Huron, Erie and Ontario during 1967 and 1968 were analyzed for species composition; 14 copepods and 13 cladoceran species were found. A general trend was seen from oligotrophic Lake Superior to eutrophic Lake Erie: the diminishing significance of calanoids accompanied by the increasing predominance of cyclopoids and cladocerans. The average crustacean abundance for Lake Erie was 400 per cm^2, which was related to the heat and chlorophyll and phosphorus content of the water. (SM)

629. Paulus, Robert D. 1969. Walleye fry food habits in Lake Erie. Ohio Fish Mono. 2. 45 p.

Walleyes, Stizostedion vitreum vitreum, have been drastically reduced in Western Lake Erie. Reasons for the population decrease are not known, but it is thought that environmental factors are somehow causing a reduction in numbers during the early fry stage. Fry and plankton collections were made in May 1964 and May 1965 at the Put-in-Bay Hatchery of the Ohio Division of Wildlife and in Western Lake Erie near the major

spawning areas of the walleye. Qualitative and quantitative plankton samples were taken concurrently with fry collections. Plankton organisms were randomly utilized by all of the observed fry. The smallest fry collected was 7.0 mm and the largest was 17.0 mm. Digestive tract analyses showed that fry of 9.0 mm or less total length ingested primarily diatoms. At about 9.0 mm, zooplankton became the principal food, although phytoplankton were utilized by fry of all observed sizes. As fry length increased, dependence on zooplankton increased and dependence on phytoplankton decreased.

630. Perkins, J. P. 1964. 17 flyways over the Great Lakes, I. Audubon. 66(5): 294-299.

The author's observations indicate that there are at least three flyways across Lake Erie used by migratory birds. They are the west end flyway, west central flyway, and central flyway. Observations do not include Eastern Lake Erie because they were made from commercial ships which did not operate in the eastern part of the Lake. 203 species were sighted. (SM)

631. Peterson, Edwin L. and Thomas M. Jarrett. 1958. Penn's Woods West. Univ. Pittsburgh Press. Pittsburgh, Penn. pp. 159-164.

A descriptive article concerning Presque Isle and the natural and manmade forces that have combined in its development. There is discussion of plant successions and progress toward a climax type of vegetation on the peninsula. Photographs are included. (SM)

Peterson, Mirdza L. - See: LeRoy E. Scarce, No. 685.

632. Peterson, Mirdza L. 1967. The occurrence of Salmonellae in streams draining Lake Erie Basin. Internat. Assoc. Great Lakes Res. Proc. 10th Conf. on Great Lakes Res. pp. 79-87.

The purpose of this investigation was: a) to demonstrate the prevalence of enteric pathogenic bacteria, such as Salmonella and Shigella, in streams draining inhabited regions in the Lake Erie Basin; b) to correlate these findings with associated microbiological parameters; and c) to interpret these results with respect to water quality and environmental health. Samples were collected at intervals in the Ottawa, Maumee,

Portage, Sandusky, Black, Rocky, Cuyahoga, Chagrin, Grand, Ashtabula, and Buffalo rivers and in the Cattaraugas Creek. Twenty-one sampling points were selected for the study. All samples were collected utilizing the gauze pad technique of Moore, with slight modification. Salmonella isolations were made from all but 7 of the 21 selected sampling points. Of 85 samples collected from 10 streams in Ohio, 39 (45.9%) yielded salmonellae; of 10 samples from 2 streams in the State of New York, 1 (10%) yielded salmonellae. A total of 180 Salmonella isolates represented 21 serotypes. Total and fecal coliform determinations were made on all samples.

633. Pettibone, Marian H. 1953. Fresh-water polychaetous annelid, *Manayunkia speciosa* Leidy, from Lake Erie. Biol. Bull. 105(1):149-153.

A description of the fresh-water sabellid polychaete genus, *Manayunkia* Leidy, collected from Western Lake Erie is presented. Also included is a brief note on their distribution. (BU)

Pfister, Robert M. - See: David L. Howard, et al. No. 367.
David L. Howard, et al. No. 368.
Walter O. Leshniowsky, et al. No. 476, 477.

634. Pfister, Robert M., Patrick R. Dugan and James I. Frea. 1968. Particulate fractions in water and the relationship to aquatic microflora. Internat. Assoc. Great Lakes Res. Proc. 11th Conf. on Great Lakes Res. pp. 111-116.

The water in Lake Erie is relatively high in suspended particulates and this may be related to reported increases in the rate of eutrophication. This report indicates that the particulates in the lake are comprised of substances having a variety of densities and that fractions can be separated which exert an influence on the growth and metabolism of microbes taken from the lake. It can therefore be concluded that specific particulates in the lake will alter the microbial ecology significantly. It has been demonstrated that other specific aquatic microbes have the capacity for accumulating inorganic micro-particulates. This in effect alters the distribution and availability of micro-particulate surfaces and may even remove them from suspension via a flocculation process. Growth of the organisms to which micro-particulates become attached is known to be controlled by available nutrients.

635. Pfister, Robert M., Patrick R. Dugan and James I. Frea. 1969. Microparticulates: Isolation from water and identification of associated chlorinated pesticides. Science. 166(3907):878-879.

Evidence in this study suggests that removal and analysis of particulates may need to be included to give more adequate estimates of pesticides in aquatic environments. In an environment such as Lake Erie, where shallow water is so easily disturbed by wind action, the turnover and accumulation of pesticides in bottom sediments may be significant. (SM)

636. Pfister, Robert M., James I. Frea, Patrick R. Dugan, Charles I. Randles, K. Zaebst, J. Duchene, T. McNair and R. Kennedy. 1970. Chlorinated hydrocarbon, microparticulate effects on microorganisms isolated from Lake Erie. Internat. Assoc. Great Lakes Res. Proc. 13th Conf. on Great Lakes Res. pp. 82-92.

Water samples from the Western Basin of Lake Erie have been analyzed with regard to the distribution of colloidal microparticles. Size analyses of particulate samples placed on a sucrose density gradient revealed that the most common size particle was in the range of 0.1 μm. Chlorinated hydrocarbon pesticides such as endrin, aldrin, heptachlor and lindane were found in association with these particles and the data suggest that aldrin and heptachlor were found more frequently on the smaller, less dense particles, while lindane was associated with the larger, more dense fractions. Bacteria isolated from these water samples prior to chemical analyses were grown in the presence of clay microparticles freed of pesticides, microparticles containing known amounts of pesticides, and purified pesticides alone. Bacterial growth effects were measured by changes in the turbidity of the medium, total DNA content of the culture and standard plate counts. Results demonstrate that different bacteria in the presence of endrin or aldrin could be affected in different ways. In some cases the organisms were stimulated to produce a cell yield of four to five times that of the control cultures. A survey of 151 heterotrophic aerobic bacteria isolated from Lake Erie has shown that 55 were stimulated by aldrin, 54 by endrin and 45 by dieldrin. Forty-six cultures were inhibited by aldrin, 43 by endrin and 43 by dieldrin. Eighteen cultures were stimulated by the three compounds, while 27 cultures were inhibited.

Phillips, R. S. - See: Charles A. Triplehorn, No. 780.

Phillips, W. Lewis - See: Ronald L. Stuckey, No. 751.

637. Pillay, K. K. S., C. C. Thomas, Jr., J. A. Sondel and C. M. Hyche. 1972. Mercury pollution of Lake Erie ecosphere. Env. Res. 5(2):172-181.

The distribution of mercury in the ecosphere of Lake Erie was monitored using a highly sensitive and reliable neutron activation analysis procedure. A variety of samples from the fauna and flora of the lake as well as those from its immediate environment were analyzed for their mercury content. The results of this survey indicate a widespread distribution of mercury in: air particulates; coal samples of the region; sediments, plankton/algae and fish samples from the lake; and in the brain tissues of long-time residents of the Lake Erie Basin.

638. Pinkava, Donald J. 1963. Vascular flora of the Miller Blue Hole and stream, Sandusky County, Ohio. Ohio J. Sci. 63(3):113-127.

This paper discusses the original and present-day vegetation of the Miller Blue Hole and stream, a tributary of Sandusky Bay. Included is a catalogue of vascular plants of the Miller Blue Hole region, which includes representatives of 281 species in 73 families. (BU)

Pope, T. E. B. - See: Carl L. Hubbs, No. 376.

Porter, Thelma - See: Jessie Finley Klocke, et al, No. 433.

639. Posten, H. W. and C. R. Ownbey. 1968. The Great Lakes water resource. J. Waterworks Assoc. 60(1):15-20.

A review of water resource problems on the Great Lakes. Lake Erie is described as having the largest population in its watershed with only token nutrient reduction by treatment plants. The need for improved institutional arrangements to provide adequate sewage treatment is discussed. A TVA of the Great Lakes is suggested. (BECPL)

640. Potos, Chris. 1968. A study of taste and odor in the municipal water supply at Cleveland, Ohio. Internat. Assoc. Great Lakes Res. Proc. 11th Conf. on Great Lakes Res. pp. 571-584.

The western suburbs of the City of Cleveland have had problems

with taste and odor in the municipal water supply for the past several years. Upon investigation it was learned that most complaints occurred when raw water temperatures were 15 to 20 degrees colder than expected surface water temperatures. It was noted that cold water temperature resulted from southerly prevailing winds. Winds from these directions will push the surface waters to the northern shores of the lake. As a result the hypolimnion of the thermally stratified lake will tilt, and become depressed in the northern area, while rising to the south, much as a saucer tilts when applying pressure to one side. During southerly winds the raw water intake will be inundated in the hypolimnion. Northerly winds will eliminate the hypolimnion from the intake area.

Biological results show that when a hypolimnion is present, and low dissolved oxygen conditions prevail, phytoplankton appear in the hypolimnion and area of the thermocline. Under these conditions large increases in total phytoplankton are also noted in the epilimnion. The total phytoplankton include varieties mentioned by Palmer (1959) as being musty taste and odor producers, the common olefactory sensation experienced during complaint periods. These varieties include Chlorella, Fragilaria, Melosira, and Mougeotia.

641. Potos, Chris. 1970. Hypolimnetic oxygen depletion mechanisms in Lake Erie. Internat. Assoc. Great Lake Res. Proc. 13th Conf. on Great Lakes Res. pp. 707-714.

To the present, the mechanism of hypolimnetic deoxygenation of temperate lakes has been little understood. It is the consensus among limnological investigators that a slow, progressive, sediment biochemical oxygen uptake rate, exerted by microbiological flora in the decomposition of sedimented plankton and other degradable organic debris, is the mechanism responsible for depleting any hypolimnion of oxygen during stratification periods. Success in the measurement of a positive depletion rate in the summer of 1968 in the Lake Erie Central Basin and correlation of this rate with existing sediment and hypolimnion oxygen demand, infers the probability of still another operative factor - that of chemical oxygen demand satisfaction. The total mechanism of the depletion, abetted by sediment resuspension due to wind-induced water turbulence, can be chemical and microbiological in nature, both at one and the same time.

Power, G. - See: M. Chen, No. 156.

Powers, Charles F. - See: Wayne P. Alley, No. 11.

642. Powers, Charles F. and Andrew Robertson. 1966. The aging Great Lakes. Scientific Am. 215(5):95-104.

Natural aging of a lake results from a process called eutrophication, which is biological enrichment of its water. Lake Erie is a prime example of a lake in which this process has been accelerated by cultural pollution, resulting in a marked change in species population of various fishes.

643. Price, John W. 1934. The embyology of the whitefish, Coregonus clupeaformis(Mitchell). Part I. Ohio J. Sci. 34(5):287-305.

The first of a series of papers representing a general survey of the embryology of the whitefish from fertilization until hatching. Samples were collected from Put-in-Bay, Ohio. This first paper traces the major events of segmentation and germ layer formation and general development up through the closure of the blastopore. (BU)

644. Price, John W. 1934. The embyology of the whitefish, Coregonus clupeaformis(Mitchell). Part II. Organogenesis. Ohio J. Sci. 34(6):399-414.

This paper is the second in a series of three papers on the embyology of the whitefish. Samples were collected from Put-in-Bay, Ohio. The author's purpose is to locate the incipient stages in the development of each of the organ systems and to trace their general development in this particular series of embryos. The completion of organogenesis marks the halfway point in the whitefish incubation period. (BU)

645. Price, John W. 1935. The embryology of the whitefish, Coregonus clupeaformis(Mitchell). Part III. The second half of the incubation period. Ohio J. Sci. 35(1):40-53.

This paper is the third in a three-part series describing the embryology of the whitefish. Samples were collected from Put-in-Bay, Ohio. The second half of the incubation period is dealt with. The development of the organ systems to produce a self-supporting, highly coordinated individual organism at the time of hatching is discussed. (BU)

646. Price, John W. 1963. A study of the food habits of some Lake Erie fish. Ohio Biol. Surv. Bull. 2(1):89 p.

A study of the food habits by means of stomach analysis of ten species of Lake Erie fish. The species studied were: smelt, yellow perch, troutperch, spot-tail shiner, sheepshead, yellow walleye, gizzard shad, alewife, white bass, and channel catfish. All specimens were collected during the 1958 season except for the alewife and walleye which were collected in 1957. A total of 14,118 fish stomachs were analyzed.

Pritschau, Michael - See: Robert G. Rolan, et al, No. 678.

647. Puleo, Joseph, Matthew C. Lanighan and Charles O. Masters. 1974. 1973 Erie County Stream Survey. Erie County Lab. Buffalo, N.Y. 294 p.

The survey was conducted between June 19 and October 3, 1973. The Sanitary Biology Section studied 18 streams for the presence of pollution bacteria (total coliform and fecal coliform bacteria) and benthic organisms, indicators of organic pollution. 67 sampling stations were established on these 18 streams. 191 benthic samples were obtained and 1462 water samples taken for sanitary bacteriological studies. Findings are detailed in the report. Streams studied which are tributary to Lake Erie are Big Sister Creek, Spring Brook, Rush Creek and Eighteenmile Creek.

648. Putnam, George Maxwell and Stephen Tilley. 1964. Sight record of the Glossy Ibis for the Bass Islands, Lake Erie, Ohio. Wilson Bull. 76(1):98.

A short note recording the sighting of the Glossy Ibis, Plegadis falcinellus, on two occasions in June and July of 1963, on North Bass Island. (SM)

Randles, Chester I. - See: Walter O. Leshniowsky, et al, No. 476, 477.
R. M. Pfister, et al, No. 636.

649. Rawson, D. S. 1952. Mean depth and the fish production of large lakes. Ecology. 33(4):513-521.

The factors affecting lake productivity may be considered in three groups, morphometric, edaphic and climatic. Using long-term commercial fish production in Canadian lakes, including Lake Erie, as an indicator of their basic productivity the author attempts to show that morphometric factors are dominant. (BU)

650. Raynes, Bertram C. 1967. How are we going to clean up Lake Erie? What's new besides ho-ho-hum? Explorer. Cleveland, Ohio. 9(2):24-26.

A brief discussion of possible treatment of sewage and industrial wastes. Mentioned is use of digested sewage sludge, removal of gross solids from storm water, and non-biological sewage treatment using a bed of pulverized coal as a filter. (SM)

Regier, Henry A. - See: Robert G. Ferguson, No. 259.
Wayne R. MacCallum, No. 497.

651. Regier, Henry A. 1968. Concepts of species segregation and desegregation related to Great Lakes fishery management. Internat. Assoc. Great Lakes Res. Proc. 11th Conf. on Great Lakes Res. pp. 124-129.

Some of the processes by which new taxa arise through segregation of segments of a gene pool, and by which existing taxa can be transformed or obliterated through subsequent desegregation, are briefly reviewed. Desegregation has apparently occurred among some coregonids in the Great Lakes. There is some evidence that it has also occurred among some forms of salmonids and percids (Stizostedion spp.). Some catastomids, cottids, cyprinids, and other percids (darters) may also have suffered desegregation, but this is conjectural since nobody seems to have studied these possibilities.

652. Regier, Henry A., Vernon C. Applegate, Richard A. Ryder, Jerry V. Manz, Robert G. Ferguson, Harry D. Van Meter and David R. Wolfert. 1969. The ecology and management of the walleye in Western Lake Erie. Great Lakes Fish. Comm. Ann Arbor, Mich. Tech. Rept. 15. 101 p.

The walleye, (Stizostedion vitreum vitreum) in Lake Erie and closely contiguous waters has supported a fishery for approximately 140 years. In the mid 1950's catches fell abruptly, in spite of intensive fishing efforts and have not rebounded in strength since 1959. This study identifies the major factors that have acted to limit the value of the walleye resource and infers how one or more of these factors might be managed to enhance the value of these fisheries. Recommendations include the conservation of the walleye resource by a combination of minimum size limit, quota, and fishing season regulations and a basic management policy geared to stabilizing the fish system.

653. Regier, Henry A. and W. L. Hartman. 1973. Lake Erie fish community: 150 years of cultural stress. Science. 180(4092):1248-1255.

A review of changes in the Lake Erie fishing industry over the past 150 years. The authors feel that cultural stresses on the fish community of Lake Erie include the following: an opportunistic, uncontrolled fishery; erosion and nutrient loadings; invading species; stream destruction and shoreline restructuring; and toxic pollutants and biocides. (SM)

654. Reigard, Jacob. 1899. The biology of the Great Lakes. Science. 9(235):906-907.

A brief paper announcing a planned lake survey during the summer of 1899. (BU)

655. Reinert, Robert E. 1970. Pesticide concentrations in Great Lakes fish. Pestic. Monit. J. 3(4):233-240.

During the past 4 years the Ann Arbor Great Lakes Fishery Laboratory has been monitoring insecticide levels in fish from the Great Lakes. The two insecticides found in all Great Lakes fish have been DDT (DDT, DDD, DDE) and dieldrin. Fish from Lake Michigan contain from 2 to 7 times as much of these insecticides as those from the other Great Lakes. Insecticide levels calculated on a whole-fish basis show a marked difference from species to species. Within a species there is also an increase in DDT and dieldrin levels with an increase in size. If these insecticide levels are, however, calculated as ppm of insecticide in the extractable fish oil, the differences in concentration between species and the differences between size groups becomes considerably less. Laboratory experiments indicate that fish can build up concentrations of DDT and dieldrin at the parts-per-million level from parts-per-trillion concentrations in the water.

656. Reinert, Robert E. and Harold L. Bergman. 1974. Residues of DDT in lake trout(_Salvelinus namaycush_) and coho salmon(_Oncorhynchus kisutch_) from the Great Lakes. J. Fish. Res. Bd. Can. 31(2):191-199.

A report on a study to determine the concentration of DDT residues accummulated at different life stages of specific fish species of the Great Lakes. Coho salmon of the 1966 year class were sampled in Lake Erie. The DDT concentration of this species was compared to that of the same species and other species from the other Great Lakes. (SM)

657. Reitz, Robert D. 1973. Distribution of phytoplankton and coliform bacteria in Lake Erie. Ohio EPA. Div. Surveillance. Columbus, Ohio. 67 p.

Conclusions of this report on bacteriological and phytoplankton data are limited to the shoreline waters of the Ohio portion of Lake Erie. The data were gathered at 14 water treatment facilities for the bacteriological data and at 10 water treatment facilities for phytoplankton data in conjunction with the Lake Erie Water Quality Program. The data were collected during the period from July 1968 through December 1972. Statistical analysis of monthly coliform means compiled during the 4-1/2 year period indicate a significant ($P<.05$) difference among months with respect to coliform counts. Lorain, Avon Lake, Mentor, Painesville, Madison, and Ashtabula exhibit a large increase during October, November and December then an abrupt decrease to lower levels in January. Other stations (Port Clinton, Lorain, Cleveland Division, Painesville) exhibit large summer increases.

Phytoplankton (algae) data appear to indicate that levels of enrichment and eutrophication have been returned to levels recorded in the 1940's at the Port Clinton area and to levels recorded in the 1920's for the Cleveland Harbor area. All stations have recorded reductions in the total phytoplankton standing crop during the 5 year sampling period. Further indications of change in Lake Erie has been the reduction of the blue-green pulse which normally causes widespread "fouling" of the water to a pulse occurring for a short time only.

658. Reitze, Arnold W. Jr. 1968. Wastes, water, and wishful thinking: The battle of Lake Erie. Case Western Reserve Law Rev. 20(1):5-86.

A review of pollution sources and resulting changes in fish populations and algal growth, as indicators of the condition of Lake Erie. Emphasis is placed on legal history of pollution abatement in Ohio, and inter-relationships of responsible agencies. Necessary measures for reversing the degradation of Lake Erie, and preserving it as a source of drinking water and as a commercial and recreational resource are discussed.

659. Rhodes, Russel G. and Anthony J. Terzis. 1970. Some algae of the upper Cuyahoga River system in Ohio. Ohio J. Sci. 70(5):295-300.

A qualitative survey of algae made during June and September, 1967, in three tributaries of the Cuyahoga River in Geauga

County: West Branch, East Branch, and Tare Creek. Sixty-four species of algae found in this survey are reported here: Eight species which were collected at the majority of the 14 stations sampled are Cladophora glomerata, Aphanochaete repens, Rhizoclonium hieroglyphicum, Euglena gracilis, Vaucheria sessilis, Tribonema bombycinum, Oscillatoria nigra and O. limosa.

660. Riddle, Lumina C. 1902. Algae from Sandusky Bay. Ohio Nat. 3(1):317-319.

A list of the algae found in Sandusky Bay and vicinity. (BU)

661. Riddle, Lumina C. 1905. Notes on the morphology of Philotria. Ohio Nat. 5(5):304-305.

A brief morphological account of Philotria canadensis collected from Sandusky Bay. (BU)

Ringer, R. K. - See: R. J. Aulerich, et al, No. 29.

662. Ritchie, Gary A. and James N. Speakman. 1973. Effects of settling time on quality of supernatant from upland dredge disposal facilities. Internat. Assoc. Great Lakes Res. Proc. 16th Conf. on Great Lakes Res. pp. 321-328.

Analysis of sediments dredged from Ashtabula and Fairport Harbors, Ohio showed coliform counts ranging from 10 to 10,000 (colonies/100 ml) in initial samples. No colonies were found after filtering by Whatman No. 541 filter paper.

663. Robb, David C. N. 1970. Land and water usage in the Lake Erie Basin. In: The Environmental Problems of the Lake Erie Basin. John Carroll Univ. Cleveland, Ohio. Carroll Business Bull. 10(1): 11-15.

This presentation includes mention of the commercial fishery in Lake Erie where the catch, by weight, amounts to 45% of the total Great Lakes catch. The emphasis on commercial fishing is expected to decline. The need for a tool to predict the effect on the lakes of any management alternative, such as reducing the input of phosphorus and its relation to algae blooms, is discussed.

Robeck, Gordon G. - See: Kenneth A. Dostal, et al, No. 234.

664. Roberts, Marvin L. 1972. *Wolffia* in the bladders of *Utricularia*: A herbivorous plant? Mich. Bot. Ann Arbor, Mich. 11(2):67-69.

In a ponded bay of Lake Erie, near Locust Point, aquatic plants of the genus *Utricularia* (bladderworts) were found to have trapped *Wolffia* (duckweed, watermeal). The observation was repeated several times through a summer and *Wolffia* was found in the traps on all visits. (SM)

Robertson, Andrew - See: Charles F. Powers, No. 642.

665. Robertson, Andrew. 1966. The distribution of calanoid copepods in the Great Lakes. Univ. Mich. Great Lakes Res. Div. Proc. 9th Conf. on Great Lakes Res. Pub. 15:129-139.

The geographical distribution of the ten calanoid copepods in the Great Lakes has been studied through a synthesis of the previously published identifications with a limited number of original determinations. Six species, *Diaptomus ashlandi*, *D. minutus*, *D. oregonensis*, *D. sicilis*, *Epischura lacustris* and *Limnocalanus macrurus*, have been found in all the lakes. *Senecella calanoides* has been found in all the lakes but Erie; and *D. reighardi* only in Erie. Two of the species that occur in all the lakes, *D. sicilis* and *L. macrurus*, are more abundant in the northern lakes; the inverse is true of *D. oregonensis*.

The relative abundances of diaptomids in Lake Michigan in 1964, in Lake Michigan in 1954-55, and in Lake Erie in 1956-57 were compared. This showed that *D. oregonensis* was relatively more abundant in Lake Erie in 1956-57, and *D. sicilis* in Lake Michigan in 1954-55. The season of maximum abundance of a species was generally earlier in Lake Erie in 1956-57 than in Lake Michigan in 1954-55. The conditions in Lake Michigan in 1964 were intermediate in both these respects.

666. Robertson, Imogene C. Strickler and Clifford L. Blakeslee. 1948. The mollusca of the Niagara Frontier region and adjacent territory. Bull. Buffalo Soc. Nat. Sci. Buffalo, N.Y. 19(3):1-191.

A systematic account of the mollusks found within a fifty mile radius of Buffalo, New York. The study area includes a part of the Niagara Peninsula in Ontario drained by the

Grand River. There is a description of each species and a note about where it has been found. Photographs of the specimens are included. (SM)

667. Rodgers, G. K. 1963. Lake Erie data report - 1960. Univ. Toronto. Great Lakes Inst. Toronto, Ont. Preliminary Rept. 11. 138 p.

This report contains predominantly limnological and meteorological data collected from the C.M.S. Porte Dauphine on several lakewide cruises. Biological data is confined to numbers of coliform bacteria.

668. Rodgers, G. K. (Ed.). 1972. Great Lakes Institute data catalogue and methods for 1960 to 1970. Univ. Toronto. Inst. Env. Sci. Eng. Toronto, Ont. Pub. EG 7. Sec. A-D. 301 p.

Section A is a general guide to the methods and instruments used to make measurements and analyze samples. Section B concerns data processing and retrieval methods. Section C contains data summary tables for 1960 through 1970 in which the number of observations, stations occupied, samples and analyses of various kinds, etc. have been tabulated for each survey. Biological entries for Lake Erie include plankton hauls, bacteria analyses, bottom samples (fauna) and fish finder records. Section D consists of survey charts on which the positions of the stations are plotted.

669. Roecker, Robert. 1961. *Osmerus mordax* - the smelt. Some big questions and a few answers about a little fish. N.Y. State Dept. Env. Cons. Albany, N.Y. Conservationist. 15(5):16-18.

An article describing the spawning habits, food and distribution of the smelt. Information concerning fishing regulations and methods used for catching the smelt, both commercially and by the individual fisherman, is included. The Lake Erie smelt fishing industry is of particular importance and is described in some detail. Over sixty Province of Ontario vessels have been licensed to trawl for smelt. (SM)

670. Rogick, Mary D. 1934. Additions to North American fresh-water bryozoa. Ohio J. Sci. 34(5):316-317.

A table on the distribution of those bryozoa collected in Lake Erie is presented. Twenty-one species and varieties of freshwater bryozoa are known from North America - sixteen of which are represented in Lake Erie. (BU)

671. Rogick, Mary D. 1934. Studies on fresh-water bryozoa. I. The occurrence of Lophopodella carteri (Hyatt) 1866 in North America. Trans. Am. Micro. Soc. 53(4):416-424.

Samples of Lophopodella carteri were collected in Western Lake Erie in 1932 and 1933. The morphological characteristics of this species are described; illustrations are also provided. (BU)

672. Rogick, Mary D. 1935. Studies on fresh-water bryozoa. II. The bryozoa of Lake Erie. Trans. Am. Micro. Soc. 54(3):245-263.

A report on the bryozoa of Lake Erie collected in the island region during 1932 and 1933. Morphological descriptions for 17 species, 10 of which were previously unreported from Lake Erie, are given. General ecological data related to these bryozoa is included. (BU)

673. Rogick, Mary D. 1935. Studies of freshwater bryozoa. III. The development of Lophopodella carteri var. typica. Ohio J. Sci. 35(6):457-463.

Contains laboratory observations of Lophopodella carteri var. typica through two generations and to the beginning of the third. Careful accounts were kept of the development of two colonies in particular - the date of their germination, the time intervals between evagination of succeeding polypides and the rate of development, release and germination of statoblasts from these colonies. (BU)

674. Rogick, Mary D. 1941. Studies on fresh-water bryozoa. X. The occurrence of Plumatella casmiana in North America. Trans. Am. Micro. Soc. 60(2):211-220.

As a result of a survey conducted around the island region of Lake Erie during 1932 and 1933, the distribution of Plumatella casmiana has been extended to North America. Measurements and figures of this species accompany this article. Additional data on the jugalis form of P. repens is also given in the form of measurements and illustrations of statoblasts. (BU)

675. Rogick, Mary D. 1943. Studies on fresh-water bryozoa. XIII. Additional Plumatella casmiana data. Trans. Am. Micro. Soc. 62(3):265-270.

A report on the findings in a 1932-33 survey of a third type of statoblast of the bryozoan, Plumatella casmiana. This enables the extension of the distribution of this species to six additional Lake Erie islands. Measurements and sketches of the 'capsuled' statoblasts and larvae are given. (BU)

676. Rogick, Mary D. and Henry van der Schalie. 1950. Studies on fresh-water bryozoa. XVII. Michigan bryozoa. Ohio J. Sci. 50(3):136-146.

The purpose of this paper was to record the occurrence of several bryozoan species from localities new to Michigan and other regions; to compile a list of the bryozoa previously recorded from Michigan; and to correct or revise the identification of some of the species collected in the past. Collection sites included a station near the mouth of the Huron River, in Lake Erie. (BU)

Rohlich, Gerald A. - See: E. Gus Fruh, et al, No. 273.

677. Rolan, Robert G. 1970. The bacteria and fungi of the Great Lakes. In: Great Lakes Basin Framework Study. Limnology of Lakes and Embayments. Great Lakes Basin Comm. Ann Arbor, Mich. Appendix 4, Draft 1. pp. 8-29 to 8-62.

This study investigates the bacteria and fungi of the Great Lakes emphasizing their roles in nutrient cycling and indicators of pollution as well as their pathogenic properties.

678. Rolan, Robert G., Nancy Zack and Michael Pritschau. 1973. Zooplankton crustacea of the Cleveland nearshore area of Lake Erie, 1971-1972. Internat. Assoc. Great Lakes Res. Proc. 16th Conf. on Great Lakes Res. pp. 116-131.

Quantitative zooplankton samples were taken at ten stations along the Cleveland nearshore area of Lake Erie at approximately monthly intervals from September 1971 through January 1973, excepting Febrary 1972. Nineteen species of Cladocera and 15 species of Copepoda were identified in these samples. The most numerous species in each group were Eubosmina coregoni, Bosmina longirostris, Daphnia galeata mendotae, Daphnia retrocurva and Cyclops bicuspidatus thomasi, Mesocyclops edax, Cyclops vernalis.

Total zooplankton densities ranged from very low ($<1K/m^3$) in March 1972 to very high ($>100K/m^3$) in July. The circannual patterns of abundance were similar to those of earlier studies,

but total abundance was significantly greater than in 1950-51. Total abundance in 1956-1957 was essentially the same as in the present study. There are notable differences in abundances of particular species, especially the appearance in relatively large numbers of Eurytemora affinis, Diatomus reighardi and Diaptomus siciloides since 1956-1957. Limnocalanus macrurus has been lost since 1951.

Roney, Harland B. - See: Charles C. Davis, No. 207.

679. Roosen, J. James and Robert C. Ball. 1971. Ecological effects of a thermal power plant on the aquatic habitat of a large fresh water lake in the United States. Proc. Eighth World Energy Conf. Bucharest, Rumania. 19 p.

Recent expansion of electrical use in the area has resulted in the siting of a 3200-megawatt fossil-fueled plant on the Michigan shore of the Western Basin of Lake Erie, the geologically oldest of the five lakes. This paper describes the qualifying and quantifying of the chemistry and biology of the aquatic environment of the lake receiving discharges from the large generating plant. Included are the design basis and description of the ecological program that was formulated by Michigan State University to determine the impact of the plant on the aquatic habitat. The paper details information to be collected in the areas of: (1) basic plant producing groups - the periphyton, the phytoplankton and the macrophytes, (2) zooplankton, (3) bottom fauna, (4) fish, and (5) waterfowl. Physical and chemical studies are also described.

Ross, C. - See: N. M. Burns, No. 109, 110, 111, 112, 113, 114.

680. Rostlund, Erhard. 1951. Three early historical reports of North American fresh-water fishes. Copeia. 1951(4):295-296.

In a recent study of fresh-water fish and fishing in aboriginal North America, the author found a few early reports of fishes which are of interest because the reports come from regions well beyond the known ranges of the species as determined from literature records, thus suggesting that natural changes in the distribution of the fishes may have taken place during relatively recent time. One such record is of the buffalofish (Ictiobus) which has been suggested is a native of Lake Erie although previously there was no record of this fish in the lake. The report is of buffalofish bones being found in an archeological site along a tributary of Western Lake Erie. (BU)

Roth, James C. - See: Clair Schelske, No. 690.

Ryder, Richard A. - See: Henry A. Regier, et al, No. 652.

681. Ryder, Richard A. 1965. A method for estimating the potential fish production of north-temperate lakes. Trans. Am. Fish. Soc. 94(3):214-218.

The study relates mean depth and total dissolved solids to fish production for thirty-four north-temperate lakes, including Lake Erie. This morphoedaphic index provides a means for estimating the potential productivity of these lakes. (BU)

Saalfeld, Robert - See: Norman S. Baldwin, No. 35.

682. Saalfeld, Robert. 1972. Role of the Great Lakes Fishery Commission. In: Proceedings of the First Federal Conference on the Great Lakes. Interagency Comm. on Mar. Sci. and Eng. of the Federal Council for Sci. and Tech. Washington, D. C. pp. 320-323.

Reference is made to the disappearance of lake herring, whitefish, and blue pike from Lake Erie. The closing cf commercial fishing for walleye and white bass due to mercury contamination is mentioned.

683. Saunders, George W. 1963. The biological characteristics of fresh water. Univ. Mich. Great Lakes Res. Div. Proc. 6th Conf. Great Lakes Res. Pub. 10. 245-255.

This paper discusses the inter-relationships in the aquatic ecosystem in terms of cause and effect. There are many environmental factors which communicate information to the organisms which then integrate the information into their protoplasm. The distribution of these organisms observed at any instant in time represents the integration. Two order systems for determining the relation between environmental factors operating and the result of this operation are presented. The first order system involves the basic feeding relationship and requires measuring rate of energy flow and the concentration of energy available as food. The second order system involves not only measuring the first order system, but also the intensity of all the environmental factors operating on this system.

Reference to Lake Erie involves the temporal distributions of total phytoplankton and specifically Fragilaria in the Western Basin.

684. Saunders, George W. 1964. Studies of primary productivity in the Great Lakes. Univ. Mich. Great Lakes Res. Div. Proc. 7th Conf. on Great Lakes Res. Pub. 11:122-129.

Data concerning photosynthesis in the Great Lakes are very scanty. There have been only two research programs which have dealt directly with photosynthesis in the Great Lakes. One of these programs attempted to gain some insight as to the distribution of photosynthesis in Western Lake Erie. The other program attempted to develop and evaluate a shipboard method for estimating photosynthesis. Some additional inference concerning photosynthesis can be made using known concentrations of chlorophyll in Lakes Superior, Michigan, Erie, and Ontario. The assumptions made using chlorophyll to calculate photosynthesis are very broad and therefore interpretation is somewhat tenuous. When results for calculated photosynthesis using all methods are compared, two points are apparent: 1) the range of photosynthetic activity in all lakes is very large, and 2) Western Lake Erie is very different from the other Great Lakes. It is more productive than many smaller lakes which are considered to be highly productive.

685. Scarce, LeRoy E. and Mirdza L. Peterson. 1966. Pathogens in streams tributary to the Great Lakes. Univ. Mich. Great Lakes Res. Div. Proc. 9th Conf. on Great Lakes Res. Pub. 15:147-154.

The Great Lakes-Illinois River Basins Project has sponsored investigation in the incidence of enteropathogens in selected streams of the Great Lakes Drainage Basins. Studies have been completed in the Lake Michigan and Lake Erie Basins. The intent of this work was to document the status of waters receiving domestic and industrial wastes in specific microbial terms and to estimate the implications relative to water resource and use. The present paper presents the study of bacterial enteropathogens as developed and executed in the waters receiving Chicago wastes.

The findings demonstrate 1) the water quality status of streams discharging urban wastes into the Great Lakes, 2) the need for improved methods of waste disposal, and 3) the necessity of increasing vigilance in the use of polluted water.

Schaffner, John H. - See: Malcom M. Stickney, et al, No. 745.

686. Schaffner, John H. 1902. The flora of Little Chicken Island. Ohio Nat. 3(2):331-332.

Brief notes concerning the flora of Little Chicken Island observed on June 22, 1902 together with a list of the 15 seed plants identified. (BU)

687. Schaffner, John H. 1914. Catalog of Ohio vascular plants. Ohio Biol. Surv. Bull. 2. 1:125-247.

A listing of the vascular plants of Ohio including those areas bordering on Lake Erie and its tributaries. The catalog is arranged according to the phyletic classification; with notes on the geographical distribution in the state based mainly on specimens in the State Herbarium, Botanical Laboratory, Ohio State University. (SM)

688. Schaffner, John H. 1932. Revised catalog of Ohio vascular plants. Ohio Biol. Surv. Bull. 25. 5(2): 89-215.

A revised listing of the vascular plants of Ohio, including those areas bordering on Lake Erie and its tributaries. The arrangement of the species and larger groups follows the phyletic system of classification as developed by the author. (SM)

689. Scheele, William. 1965. Family field trip, winter birds in Northwestern Ohio. Explorer. Cleveland, Ohio. 7(1):10-15.

An article concerning areas where waterfowl congregate when the waters of Lake Erie and surrounding bays and rivers begin to freeze over. Areas recommended for viewing birds include; 1) Castilia Pond, fed by the same underground stream which feeds the Blue Hole, 2) the Sandusky Bay bridge; 3) the duck hunting marshes near Port Clinton, 4) a farm at the intersection of routes 523 and 19, famous as a gathering place for Canada Geese. (SM)

690. Schelske, Claire and James C. Roth. 1973. Limnological survey of Lakes Michigan, Superior, Huron and Erie. Univ. of Mich. Great Lakes Res. Div. Pub. 17. 108 p.

A report on an extensive survey of the physical, chemical and

biological characteristics of Lakes Michigan, Superior, Huron and Erie conducted during the summer of 1970. There were 20 sampling stations located throughout the western portion of Lake Erie. Data for each lake is discussed separately followed by a comparison of the lakes.

Schibi, Michael J. - See: Richard L. Carr, et al, No. 147.

691. Schindler, D. W. 1974. Eutrophication and recovery in experimental lakes: Implications for lake management. Science. 184:897-899.

Combinations of phosphorus, nitrogen, and carbon were added to several small lakes in northwestern Ontario, Canada, at rates similar to those in many culturally eutrophied lakes. Phosphate and nitrate caused rapid eutrophication. When two basins of one lake were fertilized with equal amounts of nitrate and sucrose, and phosphorus was also added to one of the basins, the phosphate-enriched basin quickly became highly eutrophic, while the basin receiving only nitrogen and carbon remained at prefertilization conditions.

The author expresses concern over eutrophication of the St. Lawrence Great Lakes and supports the view that a basin-wide ban on detergent phosphates would bring about a partial recovery of Lakes Erie and Ontario.

Schmitt, J. A. - See: E. S. Beneke, No. 63.

692. Schmitt, J. A. and E. S. Beneke. 1962. Aquatic fungi from South Bass and neighboring islands in Western Lake Erie. 11. Additional biflagellate and uniflagellate Phycomycetes. Ohio J. Sci. 62(1):11-12.

Twenty-six genera or species of aquatic Phycomycetes were collected and identified during June-July, 1960, in the vicinity of South Bass Island in Western Lake Erie. Six of these are reported from Ohio for the first time. An isolate from Miller's Blue Hole near Castalia, Ohio, possibly referable to *Pythium cystosiphon*, is discussed. The relative absence of members of the Chytridiales in samples from the South Bass Island vicinity is also discussed.

693. Schneider, R. Stephen (Ed.). 1970. An industrial view: What on earth is pollution? Limnos. 3(4):10-17.

Lake Erie is briefly discussed from the point of view that the lake is not dying. The relationship between eutrophication and fish abundance as well as the fact that the western end of Lake Erie is filling are reviewed.

694. Schrag, Peter. 1969. Life on a dying lake. Saturday Rev. Sept. 20. pp. 19-21,55-56.

The waters of Lake Erie and its tributaries are in a deplorable condition. The cause of this sad state is the indiscriminant dumping of wastes into the lake by both industries and municipalities alike. The direct result of this pollution is the loss of many valuable species of fish as well as the loss of the lake as a source of recreation.

695. Scott, Donald C. 1955. Activity patterns of perch, _Perca flavescens_, in Rondeau Bay of Lake Erie. _Ecology._ 36(2):320-327.

Activity patterns of various fishes were studied at Rondeau Bay, Ontario in 1951 and 1952. Perch were found to be the most abundant fish large enough to be caught by gill-nets. The perch were divided into two chief groups: 1)migratory, traveling dailing into Lake Erie, and 2)non-migratory, remaining in the bay. Data shows that the activity patterns of these two classes vary during daylight hours, but both classes were inactive during the hours of darkness. (SM)

696. Scott, W. B. 1952. Records of the western lake chubsucker, _Erimyzon sucetta kennerleyi_, from Ontario, Canada. _Copeia._ 1952(3):203.

A report on the historical records of the appearance of the western lake chubsucker in Ontario. Their first appearance was in 1949, in ponds around Point Pelee which are separated from Lake Erie by sandbars for part of the year. (BU)

697. Scott, W. B. 1967. Freshwater Fishes of Eastern Canada. Univ. Toronto Press. Toronto, Ont. Second Ed. 137 p.

A book intended to provide game and commercial fishermen with information concerning freshwater fishes in Eastern Canada and assist in accurate identification of species. 154 species are given consideration. Common and scientific names are included. Distinguishing features are described as well as size, occurrence, life history, habits and food of adults. Changes in the Lake Erie fishery are noted. Photographs of a number of species are also included. (SM)

698. Scott, W. B. and Stanford H. Smith. 1962. The occurrence of the longjaw cisco, _Leucichthys alpenae_, in Lake Erie. _J. Fish Res. Bd. Can._ 19(6):1013-1023.

The longjaw cisco, Leucichthys alpenae, is shown to be a species new to the Lake Erie fauna. The taxonomic work on Lake Erie ciscoes is reviewed. Thirty three specimens of L. alpenae taken in 1946, 1947 and 1957 are compared morphometrically with Leucichthys artedi of Lake Erie, the only other cisco species in the lake. L. alpenae has a longer and deeper head, longer maxillary and fewer gill rakers. L. alpenae is more distinct from L. artedi in Lake Huron than in Lake Erie. The rate of growth of L. alpenae in Lake Erie compares favourably with that in Lake Michigan.

Seagran, H. L. - See: R. J. Aulerich, No. 29.

699. Sears, Paul B. 1914. The insect galls of Cedar Point and vicinity. Ohio Nat. 15(2):377-392.

A list of 63 insect galls collected during the summer of 1914 at Cedar Point. (BU)

700. Sengbusch, William C. 1949. Lake Erie. N.Y. State Dept. Env. Cons. Albany, N.Y. Conservationist. 3(5):26-27.

A general discussion of Lake Erie's physical characteristics as well as its economic importance. The commercial and recreational fishing in the lake is mentioned in some detail.

701. Shelford, V. E. and M. W. Boesel. 1942. Bottom animal communities of the island area of Western Lake Erie in the summer of 1937. Ohio J. Sci. 42(5): 179-190.

A qualitative and quantitative study was made of the bottom communities in the island region north of Sandusky Bay, Ohio.

Shema, Robert L. - See: Daniel G. Bardarik, et al, No. 46.

Shepherd, William F. - See: Harry D. Van Meter, No. 812.

702. Sibley, C. K. 1929. The food of certain fishes of the Lake Erie drainage basin. In: A Biological Survey of the Erie-Niagara System. N.Y. Dept. Cons. Albany, N.Y. Suppl. 18th Ann. Rept. (1928). pp. 180-188.

During the summer of 1928 food records were obtained for 64 species of fish. The alimentary tracts of 2,010 individuals were examined and 1,128 of these contained food.

In all cases, the length to the base of the tail is used, that is, the distance from the end of the snout to the end of the vertebral column. The percentages given are estimates of the volume of the various food organisms present in stomachs. The species examined are grouped according to food preferences in order to facilitate comparison.

Sikes, Charles Steven - See: Edwin J. Skoch, No. 707.

703. Simpson, George D. and Lamont W. Curtis. 1969. Treatment of combined sewer overflows and surface waters at Celveland, Ohio. J. Water Pollution Control Federation. 41(2):151-168.

A feasibility study of one alternative to complete sewer separation for a large city. The method under study was a large stabilization-retention basin in the off-shore water of Lake Erie as a method of treating combined sewer overflow, polluted surface waters and wastewater treatment plant effluent. It is believed that such a basin could be an effective treatment device with associated secondary benefits. The study indicated that the basin would provide a higher degree of pollution abatement than sewer separation at about one-third the cost. (BECPL)

704. Simpson, George D., Lamont W. Curtis and Henry K. Merkle. 1969. The Cuyahoga River: Lake Rockwell to Lake Erie. In: G. Dennis Cooke (Ed.), The Cuyahoga River Watershed. Kent State Univ., Inst. Limnology. Kent, Ohio. pp. 87-120.

A survey of the chemical, biological, and physical characteristics of the Cuyahoga River from Lake Rockwell to Lake Erie. Forty-three sampling sites were established along this route, and sampling took place weekly from June to September, 1967. Characteristics found are listed for each sampling site.

Simpson, R. W. - See: G. E. Symons, No. 755.

705. Skoch, Edwin J. 1970. Keynote address. In: The Environmental Problems of the Lake Erie Basin. John Carroll Univ. Cleveland, Ohio. Carroll Business Bull. 10(1):5-6.

In this keynote address for the conference on the Environmental Problems of the Lake Erie Basin, pollutants are classified into four categories: chemical, biological, physical, and physiological. Biological pollutants are the organisms, such as bacteria and protozoa, which originate in the intestinal tracts of man and other animals and are associated with disease transmission. Physiological pollutants are combinations of the

above which manifest themselves as objectionable tastes or odors in the water or in the fish we eat.

706. Skoch, Edwin J. 1970. The nekton of the St. Lawrence Great Lakes. In: Great Lakes Basin Framework Study. Limnology of Lakes and Embayments. Great Lakes Basin Comm. Ann Arbor, Mich. Draft 1. Appendix 4. pp. 8-1 - 8-28.

This paper presents the population changes in the major faunal groups inhabiting Lake Erie.

707. Skoch, Edwin J. and Charles Steven Sikes. 1973. Mercury concentrations in chironomid larvae and sediments from Sandusky Bay of Lake Erie: Evidence of seasonal cycling of mercury. Internat. Assoc. Great Lakes Res. Proc. 16th Conf. on Great Lakes Res. pp. 183-189.

Chironomid larvae, sediment and water were collected on a monthly basis at two sites in Sandusky Bay of Lake Erie from February through November 1972. The mercury concentrations in each were analyzed to illustrate the relationships between the three. Comparison of concentrations of mercury in sediment and organisms show no correlation between the two. Although monthly mercury variation was shown in the sediments, a seasonal variation was found in the chironomid larvae.

708. Smith, H. G., R. K. Burnard, E. E. Good and J. M. Keener. 1973. Rare and endangered vertebrates of Ohio. Ohio J. Sci. 73(5):257-271.

This paper, an annotated list of Ohio's rare and endangered vertebrate species, was compiled to supplement a similar national list and includes 10 mammals, 62 birds, 10 reptiles, 4 amphibians, and 33 fishes. Where possible, suggestions are made both to causes of the rare or endangered status of these species and to means of halting the trend. Ratings of "endangered," "rare," "peripheral," or "undetermined," as defined for the national classification, are given for each species.

709. Smith, H. M. 1898. Biological survey of Lake Erie. Science. 8(183):13-14.

A brief paper announcing a planned survey of Lake Erie during the summer of 1898. The investigators who will take part in this survey are named and their assignment areas are given. (BU)

Smith, Stanford H. - See: William I. Aron, No. 28.
W. B. Scott, No. 698.

710. Smith, Stanford H. 1956. Limnological surveys of the Great Lakes - early and recent. Trans. Am. Fish. Soc. 86:409-418.

Early explorations on the Great Lakes were concerned largely with things easily collected or observed, i.e. common organisms, water levels, surface temperatures, etc. Effective surveys became possible only through inter-agency cooperation which permits a pooling of facilities, staff, and equipment. Expansion of limnological research on the Great Lakes has been rapid in later years and the outlook for the future is good.

711. Smith, Stanford H. 1962. Lake Erie or Lake Eerie? Izaak Walton Mag. 27(4):4-5.

Lake Erie is aging at a rapid rate due to cultural pollution. Changes in its biological characteristics are already threatening its potential industrial and recreational usefulness. Some of these changes are pointed out.

712. Smith, Stanford H. 1964. The taxonomic status of Leucichthys macropterus, a cisco of Lake Erie. Copeia. 1964(1):230.

A description of the gill and fin characteristics of Leucichthys macropterus.

713. Smith, Stanford H. 1968. Species succession and fishery exploitation in the Great Lakes. J. Fish. Res. Bd. Can. 25(4):667-693.

The species composition of fish in the Great Lakes has undergone continual change since the earliest records, some of which were caused by enrichment of the environment, while others primarily by an intensive and selective fishery for certain species. Major changes related to the fishery were less frequent before the late 1930's than in recent years and involved few species. The successive collapse of various stocks after periods of stable production may give some indication of their sustained yield. Careful stocking programs and fisheries and coordination of management among the various states of the United States and the Province of Canada (Ontario) which manage the fish stocks, will be required to restore and maintain a useful fishery balance.

714. Smith, Stanford H. 1968. That little pest the alewife. Limnos. 1(2):12-20.

This article is concerned with the general characteristics of the alewife. The alewife population in Lake Erie has not prospered due to the low temperatures in the winter months and the shallowness of the lake. Another factor limiting the alewife in Lake Erie is the abundance of predators in this lake.

715. Smith, Stanford H. 1970. Species interactions of the alewife in the Great Lakes. Trans. Am. Fish. Soc. 99(4):754-765.

The alewife (Alosa pseudoharengus) has caused serious problems in the Great Lakes. Mention is made of the alewife's inability to become a dominant species in Lake Erie, which is probably due to the high abundance of predators in the lake.

716. Smith, Stanford H. 1970. Trends in fishery management of the Great Lakes. In: Norman G. Benson (Ed.), A Century of Fisheries in North America. Am. Fish. Soc. Spec. Pub. 7:107-114.

A discussion of the problems of the fisheries of the Great Lakes. Several fish species are listed as being reduced or eliminated due to overfishing and the sea lamprey.

717. Smith, Stanford H. 1972. Destruction of the ecosystem in the Great Lakes and possibilities for its reconstruction. Univ. Wash. Seattle, Wash. Pub. in Fish. New Ser. Progress in Fish. and Food Sci. 5:41-46.

The settlement of the Great Lakes drainage has caused the progressive deterioration of the fish population and the environment of this region. The effects of marine invaders, deterioration of water quality, and intensive and selective fishery on Lake Erie and the other Great Lakes are discussed. In closing the author points out the problems associated with the restoration of these waters.

718. Smith, Stanford H. 1972. Factors of ecologic succession in oligotrophic fish communities of the Laurentian Great Lakes. J. Fish. Res. Bd. Can. 29(6):717-730.

Oligotrophic fish communities of the Great Lakes have undergone successive disruptions since the mid-1800's. The major contributing factors, intensive selective fisheries, extreme modification of the drainage, invasion of marine species, and progressive physical-chemical changes of the lake environments are discussed. The affects of these factors on the fish communities of Lake Erie are extensively analyzed. (SM)

719. Smith, Stanford H. 1972. The future of salmonid communities in the Laurentian Great Lakes. J. Fish. Res. Bd. Can. 29(6):951-957.

The effects of human population growth, industrialization and the introduction of marine fishes have reduced the suitability of each of the Great Lakes for oligotrophic fish communities. The resulting depletion of the fisheries of each lake is discussed. (SM)

720. Smith, Stanford H. 1972. Research grants for fisheries of the Great Lakes. In: Proceedings of the First Federal Conference on the Great Lakes. Interagency Committee on Mar. Sci. and Eng. of the Federal Council for Sci. and Tech. Washington, D. C. pp. 220-224.

Lake Erie has benefited from commercial fishery research and development funds. These funds enabled Ohio to conduct a two year study to determine the commercial importance of white bass and channel catfish in the lake and Sandusky Bay. The relative abundance of each species in these waters and the effectiveness of various commercial gears has been studied so that accurate predictions of harvestable crops can be determined.

A three year study was conducted by the State of Pennsylvania to evaluate the feasibility of success in a program to augment blue pike populations.

721. Snow, Philip D. and Don S. Thompson. 1968. Comparisons of hydroxy-apatite saturations and plankton concentrations in Lake Erie. Internat. Assoc. Great Lakes Res. Proc. 11th Conf. on Great Lakes Res. pp. 130-136.

The saturation of hyrdoxy-apatite and plankton concentrations in Lake Erie are compared and their interdependences are noted. The Eastern and Central Basin waters appear to be undersaturated with respect to hydroxy-apatite, but the Western Basin waters are near saturation (late fall) or supersaturated (late summer) with respect to hydroxy-apatite. In the late fall, the plankton concentrations are low in the Eastern and Central waters and are predominantely copepods and cladocerans. The Western Basin has a much higher plankton concentration and are predominately blue-green algae. In the late summer, a similar pattern predominates, but the concentrations are much higher and plankton types are different. This suggests a relationship between plankton concentrations and the degree of saturation of hydroxy-apatite, or a close relationship of inorganic phosphate reac-

tions and organic (biological) phosphate reactions.

Sondel, J. A. - See: K. K. S. Pillay, et al, No. 637.

Soyungenc, Marjorie. - See: L. R. Hedrick, et al, No. 344.

722. Spangler, M. B. 1969. The role of marine sciences in the multiple uses of the coastal zone of Lake Erie and Lake Superior. National Planning Assoc. Center for Techno-Economic Studies. Washington, D. C. Rept. PB 185 163. 302 p.

The results of a study designed to derive important general principles concerning marine and related science and technology and institutional developments which can contribute to effective social and economic utilization of the nation's coastal margins; and to determine the unique characteristics of the different coastal regions as quidelines to formulating research needs and making decisions tailored to the socio-economic activity along these coastal areas. This study has sought to identify measures in marine sciences which can be applied to promoting the optimum use of the coastal zone of the Great Lakes. Lakes Superior and Erie were selected for this study because of their contrasting characteristics.

Speakman, James N. - See: Gary A. Ritchie, No. 662.

723. Speery, Kathleen. 1967. The battle of Lake Erie: Eutrophication and political fragmentation. Science. 158(3799):351-355.

A general article describing the eutrophication problem in Lake Erie with comment on its relationship to phosphates which enter the lake through sewage and detergents. Photographs of algal masses along the lake are included. Legislative action concerning the problem is discussed. (SM)

724. Sport Fishing Institute. 1966. Lake Erie fishing. SFI Bull. Washington, D. C. 173:2.

The results of a sample census of Ohio anglers fishing Lake Erie. Results showed that from June to mid-October 1965, 30,000 anglers caught 570,000 fish, 87% of which were yellow perch.

725. Sport Fishing Institute. 1966. Lake Erie walleyes. SFI Bull. Washington, D. C. 172:1.

An outline of Ohio's 1966 regulations designed to assure the

survival to maturity of a substantial stock of walleyes for spawning in Lake Erie.

726. Sport Fishing Institute. 1966. Winter fishing. SFI Bull. Washington, D. C. 175:4.

The results of a census of ice fishing from mid-January through February, 1966 in the Ohio waters of Lake Erie.

727. Sport Fishing Institute. 1968. Great Lakes stripers? SFI Bull. Washington, D. C. 199:3.

A brief article discussing the study being conducted by the Michigan Conservation Department into the feasibility of establishing striped bass in Lake Erie.

728. Sport Fishing Institute. 1968. Lake Erie nets. SFI Bull. Washington, D. C. 193:4-5.

A summary of a statement from the Ohio Division of Wildlife outlining new fishing regulations for the spring of 1968. These regulations included: banning the use of the gill net in Western Lake Erie; maximum gill net size of 3 1/4 inches in the Eastern Basin; trout and salmon may not be taken by use of commercial gear and; sauger and sturgeon may not be taken by either commercial or sport fishermen.

729. Sport Fishing Institute. 1969. Lake Erie walleye regulations. SFI Bull. Washington, D. C. 210:6.

A summary of the regulations necessary to improve the valuable sport and commercial fishery of Lake Erie with emphasis on the walleye.

730. Sport Fishing Institute. 1970. Fishing restrictions re mercury. SFI Bull. Washington, D. C. 219:2-3.

A listing of the extent and nature of state imposed fishing restrictions because of mercury contamination. Lake Erie is listed for Michigan and Ohio as being closed for sporting and commercial fishing for several species. All states bordering on Lake Erie have issued warnings for sport fishing.

731. Sport Fishing Institute. 1970. Lake Erie walleye regulations. SFI Bull. Washington, D. C. 211:6.

This article summarizes steps taken by Ohio, Michigan, and Ontario to protect the future abundance of the walleye in Lake

Erie. Restrictions of the use of gill nets by commercial fisheries are also mentioned.

732. Sport Fishing Institute. 1970. Mercury pollution. SFI Bull. Washington, D. C. 214:6.

The problem of mercury contamination of fish is discussed. Lake Erie is mentioned in the context of Canadian legislation banning the sale and export of pickeral and perch, passed on April 2, 1970 due to possible mercury contamination.

733. Sport Fishing Institute. 1970. Most angling waters mercury-safe. SFI Bull. Washington, D. C. 218: 1-3.

After extensive nationwide checking of waters by Federal and State water pollution experts, it is becoming evident that most waters are mercury-safe from the standpoint of sport fishing. The Great Lakes, except Lake Superior and Lake Michigan, have been reported as seriously contaminated; in Western Lake Erie however only white bass and walleyes are contaminated at dangerous levels.

734. Sport Fishing Institute. 1971. Lake Erie grass carp? SFI Bull. Washington, D. C. 223:5-6.

A critical review of the Prospectus for Great Lakes Sport Fishery Research, released in 1970 by the U.S. Bureau of Sport Fisheries and Wildlife. This article challenges the pesimistic viewpoint of the publication concerning the future of Lake Erie. Also challenged is the B.S.F.W. suggestion that exotic fish, white amur(grass carp) and the Hucho hucho(Danube salmon) be studied for the possible introduction to Lake Erie.

735. Sport Fishing Institute. 1971. Mercury pollution survey. SFI Bull. Washington, D. C. 221:4-7.

A listing of the status of mercury pollution of natural resources under the jurisdiction of 45 states. The data was compiled by the Federal Water Quality Administration. All 4 states bordering Lake Erie warn sportsmen not to eat fish caught in Lake Erie.

736. Sport Fishing Institute. 1973. Lake Erie much alive. SFI Bull. Washington, D.C. 224:7-8.

Fish catch figures for coho and chinook salmon as well as rainbow trout are presented in support of Lake Erie being a viable ecosystem.

737. Sport Fishing Institute. 1973. Much-alive Lake Erie. SFI Bull. Washington, D. C. 241:4-5.

The idea of creating a substantial salmon fishery in Lake Erie is discussed. Reports of the lake being dead are also refuted.

738. Stack, Joseph. 1920. Aquatic life: with special reference to Entomostraca. Am. Mid. Nat. 6(7):128-145.

A report on a zoological survey of Beimiller's Cove, Cedar Point, Ohio and of numerous ponds and streams in that vicinity. The survey was confined for the most part to invertebrate forms. (BU)

739. Steggles, W. A. and J. Thon. 1968. Effects of waste discharge on harbour areas. Internat. Assoc. Great Lakes Res. Proc. 11th Conf. on Great Lakes Res. pp. 588-592.

Study of waste dispersion at Wheatly Harbour, east of Pelee Point in 1966 and 1967 and at Leamington Harbour, west of Pelee Point in 1967 included collection of data on coliform densities. Rapid dispersion of waste material at the mouth of Wheatly Harbour was noted in both surveys. Average concentrations at stations located within 500 feet from the harbour mouth do not reflect the effects of waste material entering the lake. Median MF coliform values at these stations were zero in 1966 and 2 organisms/100 ml during 1967, the corresponding coliform densities in the harbour area ranged from 23 to 800 thousand in 1966 and 42 thousand to 1.8 million in 1967.

At Leamington Harbour coliform densities in excess of 2,400/100 ml were traced over a distance of 2 miles south-east of the waste discharge point.

740. Stehle, Mabel E. 1923. Surface plankton protozoa from Lake Erie in the Put-in-Bay region. Ohio J. Sci. 23(1):41-54.

A qualitative and quantitative analysis of the species of surface plankton protozoa collected from Fishery Bay, Terwilliger's Pond and the open lake is presented in tabular form. This is followed by a brief discussion of the diurnal migration of the protozoans. (BU)

Steinbach, Frank. - See: Clarence F. Clark, No. 163.

Stephenson, M. E. - See: C. S. Annett, et al, No. 20.

741. Sterki, Victor. 1907. A preliminary catalogue of the land and fresh-water Mollusca of Ohio. Proc. Ohio State Acad. Sci. Spec. Paper 12. 4(8): 367-402.

A catalogue of Ohio Mollusca recognized by the author, or cited on good authority. About 30 species of Unionidae have been seen by the author in Lake Erie. They are generally smaller, of different shapes, and often of different colors from those found in the rivers.

A few lake forms of Sphaeridae and Gastropoda have been found. It is suggested that all Mollusca of the lake should be systematically collected and compared with the inland forms as well as with those of the other Great Lakes. (SM)

742. Sterki, Victor. 1914. Ohio Mollusca. Additions and corrections. Ohio Nat. 14(5):270-272.

A list of mollusks collected in northern Ohio is presented. Several of the collections were made from Lake Erie and its tributaries. (BU)

743. Sterki, Victor. 1916. A preliminary catalog of the North American Sphaeriidae. Annals Carnegie Mus. Pittsburgh, Penn. 10(1,2):429-477.

The catalog presents known forms of Sphaeriidae with their habitat and location of fossil finds for each form. No listed species is attributed to Lake Erie. Mention is made of the need to do systematic collection in Lakes Michigan and Erie and compare the fauna of the several lakes. (SM)

744. Stevenson, Anne L. and William S. Benninghoff. 1969. Late post-glacial rise of Lake Erie and changes in vegetation on the Maumee Lake plain. Internat. Assoc. Great Lakes Res. Proc. 12th Conf. on Great Lakes Res. pp. 347-350.

Benthic sampling on the southern coast of the Western Basin of Lake Erie reveals that a forest once existed at this site, suggesting a recent and continuous rise of the lake in the Bass Island area.

Steward, Kenton M. - See: E. Gus Fruh, et al, No. 273.

745. Stickney, Malcolm M., John H. Schaffner and Clara A. Davies. 1910. Additions to the flora of Cedar Point. III. Ohio Nat. 10(3):61-63.

A list of additional Cedar Point flora is presented. Also given are the species catalogued as occurring on Cedar Point in Professor E. L. Moseley's unpublished records of the flora of Sandusky. (BU)

Stuckey, Ronald L. - See: Thomas Duncan, No. 239.
Alan W. Wentz, No. 857.

746. Stuckey, Ronald L. 1967. The "lost" plants of Thomas Nuttall's 1810 expedition into the old Northwest. Mich. Bot. Ann Arbor, Mich. 6(3):81-94.

A report on the probable identity of plants collected by Thomas Nuttall on a walking tour along the southern shore of Lake Erie and through the northwest in 1810. The plants were lost and replaced on a later expedition. Locality data for 20 species from the Great Lakes Region is given. (SM)

747. Stuckey, Ronald L. 1968. Distributional history of Butomus umbellatus (flowering-rush) in the Western Lake Erie and Lake St. Clair region. Mich. Bot. Ann Arbor, Mich. 7:134-142.

This article concerns the distributional history of the flowering-rush in the Western Lake Erie region. The species was introduced from Europe but the date of this introduction is disputed. The author attempts to interpret previous investigations.

748. Stuckey, Ronald L. 1969. The introduction and spread of Lycopus asper (western water horehound) in the Western Lake Erie and Lake St. Clair region. Mich. Bot. Ann Arbor, Mich. 8(2):111-120.

This paper compares data from past literature and herbarium specimen records with modern surveys of plants in the field. The evidence indicates that Lycopus asper Greene, a species indigenous to western North America, is non-indigenous to the shore flora of the Western Lake Erie region.

749. Stuckey, Ronald L. 1970. Distributional history of Epilobium hirsutum (great hairy willow-herb) in North America. Rhodora. 72(790):164-181.

The known distribution of a member of the evening primrose family (Onagraceae), Epilobium hirsutum L., is described in this article. The species has become established in eastern North America in the past 140 years. A map of its distribution with dates of the oldest known collection of

of the plant for each locality is included. (SM)

750. Stuckey, Ronald L. 1971. Changes of vascular aquatic flowering plants during 70 years in Put-in-Bay Harbor, Lake Erie, Ohio. Ohio J. Sci. 71(6): 321-342.

Based on a survey in 1898, 40 spp. of vascular aquatic flowering plants were reported for Put-in-Bay Harbor in Western Lake Erie. Studies of this flora at various times since then have revealed a loss of species from this harbor to the extent that today 20 spp. of the originial 40, or 50%, of the flora has disappeared. Only 3 of the original 40 can be considered to be common or abundant today in the harbor. During the same 70-yr period, only 4 submersed species have invaded the harbor. Possible reasons for these changes, such as increase in water temperature, decrease in oxygen, increase in turbidity, and man's influence on the harbor by dredging, building retaining walls, increasing use of motor boats, dumping of domestic sewage, and runoff from agricultural land are all considered as possible factors that have, independently and interrelatedly, in part or in total, been responsible for this 50% loss in species composition. (BU)

751. Stuckey, Ronald L. and W. Lewis Phillips. 1970. Distributional history of Lycopus europaeus (European water-horehound) in North America. Rhodora. 72(791):351-369.

This article traces the distributional history of Lycopus europaeus in northeast North America. Included is a distribution map showing the date of the earliest known collection of the plant for each locality. It is thought that the species invaded Western Lake Erie via a water route rather than overland and is now being spread in Western Lake Erie by propagules. (SM)

Swales, B. H. - See: P. A. Taverner, No. 764.

752. Sweeney, Robert A. (Ed.). 1969. Problems and techniques. In: Proceedings of the Conference on Changes in the Biota of Lakes Erie and Ontario. Bull. Buffalo Soc. Nat. Sci. Buffalo, N.Y. 25(1):72-84.

Problems encountered and techniques employed in the collection and analysis of aquatic organisms are discussed.

753. Sweeney, Robert A. (Ed.). 1969. Proceedings of the Conference on Changes in the Biota of Lakes Erie and Ontario. Bull. Buffalo Soc. Nat. Sci. Buffalo, N.Y. 25(1):84 p.

This conference dealt with the changes in the biology of the lower Great Lakes (See: C. A. Dambach, No. 189), the changes in the plants (See: C. C. Davis, No. 205), and the changes in the benthos (See: R. A. Brinkhurst, No. 86).

754. Sweeney, Robert A. 1970. Great Lakes organizations: The Great Lakes Laboratory of the State University College at Buffalo. Limnos. 3(1):13-17.

A general description of the structure and function of the Great Lakes Laboratory of the State University College at Buffalo. Included is a brief description of the fish protein concentrate (FPC) project. The most abundant types of fish in Lake Erie, trash fish, are listed as well as those types which were replaced.

Swenson, Marlette E. - See: Arthur D. Hasler, No. 339.

755. Symons, G. E. and R. W. Simpson. 1938. Report on fish destruction in the Niagara River in 1937. Trans. Am. Fish. Soc. 68:246-255.

The paper reports on the studies made to determine the possible cause or causes of three epidemics of fish mortality which occurred during November and December, 1937, in the vicinity of Buffalo, New York. Samples of water and dead fish were analyzed to determine the lethal agent responsible for the slaughter. Combination of wind velocity and direction, rainfall, and changes in lake level caused sudden discharges of the polluted waters of a small stream, dredged to form part of the Buffalo Harbor, into the Niagara River. At such times fish were frequently observed to die. At the time of the three periods of fish mortality some extremely lethal agent seemed to be present that normally must be absent, because the fish mortality was so much greater than had ever been observed previously.

Tack, Peter I. - See: Jessie Finley Klocke, et al, No. 433.
Jessie Finley Klocke, et al, No. 434.

Taft, Celeste W. - See: Clarence E. Taft, No. 761.

Taft, Clarence E. - See: James P. Abrams, No. 1.
Robert F. Normandin, No. 597.
W. Jack Kishler, No. 430.

756. Taft, Clarence E. 1940. Asexual and sexual reproduction in Platydorina caudata Kofoid. Trans. Am. Micro. Soc. 59(1):1-11.

Colonies of Platydorina caudata were observed in Terwilliger's Pond on South Bass Island, Ohio in 1938. Examination of these colonies yielded evidence of the previously unknown sexual reproductive stage of this species. Its life history is described along with various other characteristics. (BU)

757. Taft, Clarence E. 1941. Inversion of the developing coenobium in Pandorina morum Bory. Trans. Am. Micro. Soc. 60(3):327-328.

A report on a study of Pandorina morum collected at Put-in-Bay, Ohio during which the author was able to follow the asexual reproduction of this organism and to observe the actual inversion of the plakea in living colonies. (BU)

758. Taft, Clarence E. 1942. Additions to the algae of the west end of Lake Erie. Ohio J. Sci. 42(6):251-256.

Contains an updating of Tiffany's reports on the algae in the island area of Lake Erie. A taxonomic description is given for the 26 species listed. (BU)

759. Taft, Clarence E. 1945. The desmids of the west end of Lake Erie. Ohio J. Sci. 45(5):180-205.

Contains a discussion of the various desmid habitats within the island region of Lake Erie followed by a taxonomic survey of the species found there. (BU)

760. Taft, Clarence E. and W. Jack Kishler. 1968. Algae from Western Lake Erie. Ohio J. Sci. 68(2): 80-83.

Four species of algae in the Chlorophyta and five in the Cyanophyta are newly reported for Western Lake Erie. Gongrosira stagnalis (G. S. West) Schmidle, collected from the basal fragments of old Cladophora, appears to be a new record for the United States. Nephrocytium obesum W. & G. S. West, which is reported as often having a shallowly scrobiculate wall, is unique and merits further intensive study.

761. Taft, Clarence E. and Celeste W. Taft. 1971. The algae of Western Lake Erie. Bull. Ohio Biol. Surv. New Series. 4(1):189 p.

The physiology of the various algal habitats existing in the island region of Western Lake Erie is discussed. This is followed by a section on the relative abundance of the algal groups. The systematic presentation includes keys to classes, orders and genera, as well as a taxonomic description and collection sites for each of the genera and species identified.

762. Tait, Howard D. 1971. Great Lakes Fishery Laboratory. In: Progress in Sport Fishery Research 1971. Bur. Sport Fish. and Wildlife. Washington, D.C. pp. 86-120.

A summary of research in 1971 on the Great Lakes divided on the basis of geographic boundaries into fishery research on each of the five lakes, and also on the basis of subject, environment, fish physiology and behavior, heavy metals and pesticides, and biometrics.

763. Tait, Howard D. 1972. Federal Great Lakes fishery objectives, priorities, and projects. In: Proceedings of the First Federal Conference on the Great Lakes. Interagency Committee on Mar. Sci. and Eng. of the Federal Council for Sci. and Tech. Washington, D.C. pp. 44-47.

Fluctuations in the abundance of walleyes and yellow perch in Lake Erie from year to year are discussed. Curtailment of commercial and sport fishing in Lake St. Clair and Lake Erie because of mercury concentrations is mentioned as an area for further exploration.

764. Taverner, P. A. and B. H. Swales. 1907. The birds of Point Pelee. Wilson Bull. 19(2):37-54.

A report on observations made in 1905, 1906 and 1907 of the birds of Point Pelee. A list of species seen is included. (SM)

Terzis, Anthony J. - See: Russel G. Rhodes, No. 659.

Thomas, C. C. Jr. - See: K. K. S. Pillay, et al, No. 637.

765. Thomas, Edward S. 1949. A population of Lake Erie water snakes. Copeia. 1949(1):76.

A note concerning observation of a large number of Natrix sipedon insularum Conant and Clay on Middle Island, Ontario.

Two specimens were captured which measured 49 inches and 50.75 inches. The average length of the snakes observed was four feet. (SM)

Thomas, N. A. - See: Allen M. Lucas, No. 491, 492.

766. Thommes, M. M., H. F. Lucas Jr. and D. N. Edgington. 1972. Mercury concentrations in fish taken from offshore areas of the Great Lakes. Internat. Assoc. Great Lakes Res. Proc. 15th Conf. on Great Lakes Res. pp. 192-197.

Twenty-four fish species collected from offshore regions of Lakes Erie, Michigan and Superior during 1967 and 1968 were analyzed for mercury concentration by the neutron activation method. For two individual species, bloater and lake trout (where individual fish sampled were of widely differing size), no correlation could be seen between mercury content and weight. The fish were grouped according to feeding habits and both significant differences and similarities were seen between trophic levels and lakes. Generally, the concentrations of mercury in piscivores were higher than those in either bottom feeders or planktivores. No significant difference was seen for the same feeding groups from each lake. It is suggested that these offshore levels result from natural geochemical sources of mercury.

Thompson, Don S. - See: Philip D. Snow, No. 721.

Thompson, L. C. _ See: Bernard S. Meyer, et al, No. 524.

Thon, J. - See: W. A. Steggles, No. 739.

Tidd, Wilbur M. - See: Stillman Wright, No. 879.

767. Tidd, Wilbur M. 1931. A list of parasitic copepods and their fish hosts from Lake Erie. Ohio J. Sci. 31(6):453-454.

A collection of parasitic copepods from Lake Erie waters made during 1927, 1928 and 1929. Fifteen hundred fish representing thirty-eight species were examined and thirteen species of copepods found, eight of which are new to Lake Erie. A list of the thirteen species new to Lake Erie together with their host is presented. (BU)

768. Tidd, Wilbur M. 1932. The burbot as a source of live material for parasite study. School Sci. and Math. 32(1):182-183.

The author proposes the use of the burbot of Lake Erie for classroom study of parasitism. Both the method and purpose of such an experiment are outlined. (BU)

769. Tidd, Wilbur M. 1934. Recent infestations of goldfish and carp by the "anchor parasite," Lernaea carassii. Trans. Am. Fish. Soc. 64:176-180.

A discussion of the effects of the "anchor parasite, "Lernaea carassii, on goldfish and carp in ponds around Western Lake Erie. A table listing eight other fish hosts as well as a frog tadpole and the locality at which each was found is included. (CCIW)

Tiffany, Lewis Hanford - See: Elbert H. Ahlstrom, No. 5.

770. Tiffany, Lewis Hanford. 1937. The filamentous algae of the west end of Lake Erie. Am. Mid. Nat. 18(6):911-951.

A systematic listing of the filamentous green, blue-green, and yellow-green algae collected during the summers of 1927-36. All specimens were obtained from the island region of Lake Erie. (BU)

771. Tiffany, Lewis Hanford and Elbert H. Ahlstrom. 1931. New and interesting plankton algae from Lake Erie. Ohio J. Sci. 31(6):455-467.

Contains a taxonomic list of the species and varieties of planktonic algae collected in the island region of Lake Erie which were not described to date. (BU)

Tilley, Stephen - See: George Maxwell Putnam, No. 648.

772. Todd, W. E. Clyde. 1904. The birds of Erie and Presque Isle, Erie County, Pennsylvania. Annals Carnegie Mus. Pittsburgh, Penn. 2:481-596.

This report is based primarily on observations made during the periods March 21 - May 31 and August 20 - November 20, 1900. These periods were chosen to cover the spring and fall migrations. Nearly 1,000 specimens were secured. Listed are 18 species thought to be permanent residents, 84 summer residents, 25 winter visitants, and 95 transient visitors. The species are listed and observations about their habits noted. Photographs of Presque Isle ponds and woodlands are included. (SM)

773. Tomkiewicz, Linda A. 1970. Typical fish mortality rates in Eastern Lake Erie. State Univ. College. Fredonia, N.Y. Lake Erie Env. Studies. Tech. Data Rept. 4. 15 p.

This study was conducted to establish a base line of natural fish mortalities in Eastern Lake Erie throughout a yearly cycle. Seasonal variations in mortality rate indices are shown graphically for the eight most common species (smelt, black bullheads, white suckers, sheepshead, yellow perch, white bass, smallmouth bass, and rock bass). No direct cause for the mortality could be given although the author stated possible causes as predation, diseases and parasitism, pollution, and physical damage caused by man. Most causes of high fish mortality rates were related to commercial and sports fishing activity.

774. Toner, G. C. 1934. Notes on the alewife. Can. Field-Nat. 48(3):51-52.

Reference is made to the fact that the alewifes' entrance to the upper Great Lakes was probably via the Welland Canal. (SM)

Touhill, C. J. - See: F. A. Butrico, et al, No. 117.

Trautman, Milton B. - See: Louis Campbell. No. 122.
Harry D. Van Meter, No. 813.
Raymond C. Osburn, et al, No. 617.

775. Trautman, Milton B. 1939. The effects of man-made modifications on the fish fauna in Lost and Gordon Creeks, Ohio, between 1887-1938. Ohio J. Sci. 39(5):275-288.

A study of the numerical fluctuations of various fish species in Lost and Gordon Creeks of the Maumee River Basin from 1887 to 1938. The author hopes to use this data to provide an understanding of the fundamental principles regulating the present numerical abundance of each species. The effect of stream dredging is emphasized. (BU)

776. Trautman, Milton B. 1943. Herring gull attack on a normal golden-eye. Wilson Bull. 55(3):192.

A brief description of a golden-eye duck being attacked by a herring gull in waves about fifty feet from shore. Following a struggle the duck escaped and out-distanced the gull. (SM)

777. Trautman, Milton B. 1944. An Ohio specimen of the purple sandpiper. Wilson Bull. 56(1):46.

A short account of the capture of a purple sandpiper specimen on Starve Island in November of 1943. Stomach analysis was performed and showed the bird had eaten mostly algae of the genus Ulothrix. Remnants of beetles, gravel, and otolith of a fish and fish scales were also found. The bird was seen feeding in Cladophora, but apparently did not consume it. (SM)

778. Trautman, Milton B. 1948. A natural hybrid catfish, Schilbeodes miurus X Schilbeodes mollis. Copeia. 1948(3):166-174.

A discussion of the hybrid between Schilbeodes miurus and S. mollis which was previously classified as S. nocturnus. A comparison of morphological characteristics is made between the hybrid and its parental types and also to S. nocturnus. Included is a possible explanation of hybridization as being a direct response to environmental conditions. (BU)

779. Trautman, Milton B. 1957. The Fishes of Ohio. Ohio State Univ. Press. Columbus, Ohio. 683 p.

A comprehensive report which attempts to demonstrate the changes in distribution and abundance of Ohio fishes which have occurred between the years 1750 to 1950, and to present reasons for these changes. Also provided are three keys for the identification of the 160 species and 12 additional subspecies known to be present within the state during this two-hundred year period. Two of the keys are designed for the students of ichthyology and are of the more conventional type. The third is designed for the layman to help in identifying the various species. A figure of each species and occasional anatomical drawings accompany this third key. (BU)

780. Triplehorn, Charles A. and R. S. Phillips. 1951. White pelican on Ohio shore of Lake Erie. Wilson Bull. 63(1):41.

A note concerning two sightings of the white pelican (Pelecanus erythrerhynches) along the south shore of the Marblehead Penninsula during the summer of 1950. (SM)

Tubb, Richard A. - See: Charles A. Barans, No. 44.

781. Tufty, Barbara. 1966. The dying lake. Sci. News. 90:10-11.

A brief editorial concerning the deleterious effects resulting from man's activities on Lake Erie.

782. Turner, Charles L. 1920. Distribution, food and fish associates of young perch in the Bass Island region of Lake Erie. Ohio J. Sci. 20(5):137-152.

Forty-two sampling sites in the Bass Island region of Lake Erie are described individually as to their physical characteristics, fauna and flora. This data was used to study the distribution and diet of the perch of this region. It was found that young perch generally remain in shore waters at a depth of between two and five feet. The diet consists of entirely copepods when young and gradually changes to insect larvae. This change in diet is associated with a change in feeding behavior from a surface feeder to a bottom feeder. (BU)

783. Turner, Clarence L. 1921. Food of the common Ohio darters. Ohio J. Sci. 22(2):41-62.

Common Ohio darters of 11 different species were collected in the Bass Island region of Lake Erie as well as from other lakes and streams of Ohio. Through stomach analysis the diets of each species was determined. Any differences in the diet within a species collected from Lake Erie as opposed to a stream or inland lake was also noted. Using this data the author divides the darters into 3 classes based upon the character of the food at the different periods in their lives. Also discussed are the factors governing food changes and the relationship between food and distribution of the darter. (BU)

784. Turner, Clarence L. 1922. Notes on the food habits of young of Cottus ictalops (Millers Thumb). Ohio J. Sci. 22(3):95-96.

Around the shores of Buckeye Island, Lake Erie, young of Cottus ictalops were fairly abundant. One hundred specimens were collected and 35 of their stomachs were analyzed for food content. The results are reported and discussed. (BU)

785. Turner, Clarence L. 1926. The crayfishes of Ohio. Ohio Biol. Surv. Bull. 13. 3(3):145-195.

A study of the crayfishes of Ohio including Lake Erie and its tributaries. Statements are made concerning historical background, external structures and their functions, copulation and reproduction, regeneration and moulting, life history and habits, economic aspects, classification, descriptions of each species and distribution. (SM)

786. U. S. Army Corps of Engineers. 1971. Cuyahoga River Basin Ohio Restoration Study. U. S. Army Corps of Eng. North Central Div. Chicago, Ill. 104 p.

This first interim report of the Cuyahoga River Restoration Study presents the scope of the longer-term framework plan plus an early-action program that will begin in fiscal 1973. Specific actions recommended to improve water quality include: (a) Reduce bacterial and viral contamination to levels safely below those recommended for total body contact; (b) Provide dissolved oxygen to levels which will promote a clean-water aquatic community; (c) Eliminate sources of excessive nutrients which promote nuisance algae growths; (d) Reduce the suspended solids load carried by the stream; (c) Terminate the release of heavy metals into the aquatic environment; and (f) Remove physical or chemical barriers to the passage of migrating fish as far upstream as Cuyahoga Falls, where natural falls constitute a barrier.

787. U. S. Army Corps of Engineers. 1973. Summary report on Cleveland-Akron Metropolitan and Three Rivers watershed areas of Ohio wastewater management study. U. S. Army Corps of Eng. North Central Div. Chicago, Ill. 207 p.

This study is concerned with the formulation, design, and assessment of the impacts of alternative plans for area-wide wastewater management for the watershed areas in northern Ohio. The basic wastewater sources considered in the study are municipal sewage, industrial waste flows, and combined and separate urban stormwater runoff. The rivers included in the Three Rivers Watershed are the Rocky River, the Cuyahoga River and the Chagrin River. Evaluation of water quality included identification of bottom dwelling organisms and determination of levels of coliform bacteria.

788. U. S. Army Corps of Engineers. 1973. Water resources development in New York. U. S. Army Corps of Eng. North Atlantic Div. New York, N.Y. 147 p.

This publication provides information on the scope and progress of water resources development within the State of New York by the U. S. Army Corps of Engineers. It describes the Corps' role in planning and building these improvements and includes an explanation of the procedure for initiating and processing them.

A brief description is included of work at Barcelona Harbor on the south shore of Lake Erie. Access was provided to a breakwater for recreational fishing. The harbor is an important center for commercial fishing.

789. U. S. Bureau of Outdoor Recreation. 1966. Water oriented outdoor recreation, Lake Erie Basin. Bur. Outdoor Recreation. Lake Central Region. Ann Arbor, Mich. 102 p.

A review of recreational demand and opportunities in the Lake Erie Basin. Included is discussion of the closing of beaches due to high coliform counts, and the negative effects of excessive aquatic growth on swimming and sport fishing.

790. U. S. Department of Health, Education, and Welfare. 1963. Water pollution surveillance system annual compilation of data October 1, 1962 - September 30, 1963. Public Health Service. Div. Water Supply and Pollution Control. Washington, D.C. 1:63-71 (Northeast Basin); 4:25-26, 85-102 (Western Great Lakes and Lake Erie Basins).

The 6th annual compilation of data is information collected by the Public Health Service Water Pollution Surveillance System (formerly the National Water Quality Network). The biological parameters associated with water quality were monitored. (BECPL)

791. U. S. Department of Health, Education and Welfare. 1965. Conference in the matter of pollution of Lake Erie and its tributaries. In: Conference Proceedings, August 3-6, 1965, Cleveland, Ohio. U. S. Dept. Health, Education, and Welfare. Washington, D. C. Vol. 1-4. 1099 p.

Proceedings of a conference held at the request of the Governor of Ohio under the provisions of Section 8 of the Federal Water Pollution Control Act. Statements concerning changes in Lake Erie and their relationship to industrial and municipal waste discharges are included. The technical

report considers the quality characteristics of the waters as they exist and trends in recent years. It evaluates the effects of waste discharges on water uses and summarizes the principal problems and needed corrections. The report is based on studies made over a two-year period under the supervision of the Department of Health, Education, and Welfare. Data obtained from other federal, state and local agencies were also used in the report.

792. U. S. Department of Health, Education, and Welfare. 1965. Conference in the matter of pollution of Lake Erie and its tributaries. In: Conference Proceedings, August 10-11, 1965, Buffalo, New York. U. S. Dept. Health, Education, and Welfare. Washington, D. C. Vol. 1-2. 467 p.

Proceedings of the conference held under the provisions of Section 8 of the Federal Water Pollution Control Act. Major sources of municipal and industrial wastes in the Pennsylvania and New York sections of Lake Erie were identified and necessary corrective actions recommended in Part 3 of the Federal Report prepared under the supervision of the Department of Health, Education and Welfare. Data obtained from other federal, state and local agencies were also used in the report. The Erie County Pennsylvania Division of Environmental Health presented a report on pollution of tributaries and condition of beaches. The New York State presentation included an explanation of the state system of stream classification. Financing of sewage treatment facilities is discussed in relation to federal, state and local responsibility.

793. U. S. Department of Health, Education, and Welfare. 1965. Conference in the matter of pollution of the navigable waters of the Detroit River and Lake Erie and their tributaries in the state of Michigan. In: Proceedings Second Session, June 15-18, 1965. U. S. Dept. Health, Education, and Welfare. Washington, D. C. Vol. 1-6. 1787 p.

A complete report of the conference proceedings held under the provisions of Section 8 of the Federal Water Pollution Control Act. An extensive report on studies by the Public Health Service analyzing the waters and bottom deposits is presented in Volumes 1-3. Forty-four types of bacteriological, chemical, physical and biochemical tests were performed. Summaries of technical data in the forms of maps, charts, graphs and tables are included in the publication.

794. U. S. Department of Health, Education, and Welfare. 1965. Report on the pollution of Lake Erie and its tributaries. Part 1: Lake Erie. U. S. Dept. Health, Education, and Welfare. Public Health Service. Div. Water Supply and Pollution Control. Washington, D.C. pp. 1-50.

This report contains a description of conditions in Lake Erie and its tributaries. There is discussion of changes in the biology of the lake during the past 35 years. Changes in the amount of algae found in water samples and changes in types of bottom organisms are noted.

795. U. S. Department of Health, Education, and Welfare. 1965. Report on the pollution of Lake Erie and its tributaries. Part 2: Ohio, Indiana and Michigan sources. U. S. Dept. Health, Education, and Welfare. Public Health Service. Div. Water Supply and Pollution Control. Washington, D. C. pp. 51-101.

This part of the report deals with problems in local areas tributary to Lake Erie within Michigan and Ohio, encompassing headwater areas in Indiana. The area is divided into six subareas: the Maumee River Basin; Western Ohio, including the Portage, Sandusky, Huron, Vermillion and Black Rivers; Rocky River Basin; Cuyahoga River Basin; Eastern Ohio, including the Grand River, Ashtabula River and Conneaut Creek; and the Detroit River and Michigan tributaries, including the Huron and Raisin Rivers.

796. U. S. Department of Health, Education, and Welfare. 1965. Report on the pollution of Lake Erie and its tributaries. Part 3: New York and Pennsylvania sources. U. S. Dept. Health, Education, and Welfare. Public Health Service. Div. Water Supply and Pollution Control. Washington, D. C. pp. 103-122.

This report describes water quality in the Pennsylvania and New York sections of Lake Erie and its tributaries under three geographical headings: the Pennsylvania Basin; the Western New York Basin; and the Erie-Niagara Basin. Sources of pollution, both industrial and municipal, are identified and recommendations made for improved sewage treatment by specific individual industries and municipalities.

797. U. S. Federal Water Pollution Control Administration. 1965. Pollution-caused fish kills in 1965. FWPCA. Washington, D. C. 28 p.

This report of pollution-caused fish kills reflects the investigation of 531 separate kills documented by state officials in 1965. Forty-four states reported that 11.75 million fish were lost because of pollution. Information is presented for Lake Erie in the vicinity of Lake County, the Maumee River and the Sandusky River regarding the date of kill, operations indicated as responsible for kill, type of fish killed (game or forage), percent of kill which was of commercial value, and the estimated number of fish killed.

798. U. S. Federal Water Pollution Control Administration. 1966. Water pollution control, waste treatment and water treatment, selected biological references on fresh and marine waters. FWPCA. Cincinnati, Ohio. 126 p.

A book of selected biological references concerning water pollution control, waste treatment, and water treatment. Several Lake Erie studies are included.

799. U. S. Federal Water Pollution Control Administration. 1967. Laboratory Manual - Cleveland Program Office. FWPCA. Cleveland Program Office. Cleveland, Ohio. 49 p.

This manual presents the procedures for chemical, biological and microbiological analysis of sediments and water as used by the laboratories of the Federal Water Pollution Control Administration, Cleveland Program Office. These procedures were employed in a surveillance program on Lake Erie which was conducted by the Cleveland Program Office.

800. U. S. Federal Water Pollution Control Administration. 1968. Lake Erie report. FWPCA. Great Lakes Region. Cleveland, Ohio. 107 p.

This report recommends a plan of action combining immediate and long-range needs. It describes the pollution problem and the ominous threat of continued pollution. It also describes what must be done to save Lake Erie, who will take these actions, and how much it will cost. Data concerning the basin, use of water, pollution problems and their causes, water quality standards, and costs for municipal and industrial waste treatment are included.

801. U. S. Federal Water Pollution Control Administration. 1968. Lake Erie environmental summary, 1963-1964. FWPCA. Great Lakes Region. Cleveland, Ohio. pp. 130-160.

Included in this environmental summary of Lake Erie are two sections pertaining to its biological aspects. The first deals with the population changes of the lake's fauna and flora. The second analyzes the bacteriological characteristics, including separate discussions on each of the three major basin regions as well as its major tributaries.

802. U. S. Federal Water Pollution Control Administration. 1968. Lake Erie surveillance data summary, 1967-1968. FWPCA. Great Lakes Region. Cleveland Program Office. Cleveland, Ohio. 65 p.

This program is a study of the chemical, biological, and microbiological conditions of Lake Erie including a survey of the lake under ice cover. Comparisons are drawn between this 1967-68 data and that obtained in 1963-64. The data indicates that dissolved solids have increased by 9% since 1964 and that most chemical constituents in both water and sediment have increased during the same period. Diatoms were found to dominate the phytoplankton populations in the spring, fall and winter; green and blue-green dominated in the summer depending on the basin.

803. U. S. Federal Water Pollution Control Administration. 1968. Lake Erie bathing beach water quality. In: Progress Evaluation Meeting: Pollution of Lake Erie and Its Tributaries - Indiana, Michigan, New York, Ohio, Pennsylvania. FWPCA. Washington, D. C. Unnumbered.

A survey of 60 beaches on Lake Erie, the purpose of which is to determine the water quality and to locate the sources of pollution. Findings indicate that all Lake Erie beaches are adversely affected, at least occassionally, by bacterial pollution, aesthetic impairment, or both. The pollution sources and principal aesthetic problems are summarized.

804. U. S. Federal Water Pollution Control Administration. 1969. Progress evaluation meeting, pollution of Lake Erie and its tributaries - Indiana, Michigan, New York, Ohio, Pennsylvania. FWPCA. Washington, D. C. 467 p.

Proceedings of a conference to evaluate progress in pollution abatement with reports from the states of Michigan, Indiana, Ohio, Pennsylvania and New York and the cities of Detroit and Celveland. Included is the Lake Erie Environmental Summary 1963-1964 and the Lake Erie Surveillance Data Summary 1967-1968 published by the Federal Water Pollution Control Administration. Material concerning proposed drilling operations for oil and gas in Lake Erie and regulation by individual states is included. Testimony concerning the disposal of dredgings from Lake Erie harbors is also presented.

805. U. S. News and World Report, Inc. 1965. Erie polluted: Ohio hollers uncle. U. S. News and World Rept. April 8. p. 55.

A general article discussing the need for federal aid in pollution control. Particular mention is made of the algae problem in the lake and the polluted condition of the Cuyahoga River.

806. U. S. News and World Report, Inc. 1965. Filth in the Great Lakes: What can be done about it. U. S. News and World Rept. December 13. pp. 58-61.

This article is based on an interview with Dr. George Langford. There is discussion of the condition of Lake Erie. Mention is made of the decline of the commercial fishing industry on Lake Erie.

807. U. S. Office of Water Resources Research. 1972. Lake Erie: a bibliography. Water Resources Sci. Info. Center. Springfield, Virginia. Info. Center Rept. WRSIC 72-209. 240 p.

This bibliography, containing 221 abstracts, is one in a series of planned bibliographies in water resources produced wholly from the information base comprising Selected Water Resources Abstracts (SWRA). At the time of search for this bibliography, the data base had 41,521 abstracts covering SWRA through May 15, 1972 (Volume 5, Number 10). Abstracts with full bibliographic details are listed in ascending Accession Number order. A descriptor index is made up of a fraction of the total descriptors and identifiers by which each paper in this bibliography has been indexed. These descriptors represent weighted terms that best describe the information content and are indicated by asterisks. Through permutation, each word in a multiple-word descriptor or identifier is made to file in its normal alphabetic order,

thus according a multiple access to each abstract. Another index lists the authors alphabetically and gives page numbers for the abstracts.

808. U. S. Water Resources Council. 1968. Great Lakes region. In: The Nation's Water Resources. U. S. Water Resources Council. Washington, D. C. Pts. 1-7. pp. 6-3-1 to 6-3-11.

This assessment of the nation's water resources includes a discussion of the problems of the Great Lakes. Lake Erie is mentioned specifically as an example of quality control problems, in particular the large amounts of algal blooms supported by nutrient additions from waste discharges. Damages to fishery and waterfowl habitat have been the immediate consequences.

809. Uthe, J. F. and E. G. Bligh. 1971. Preliminary survey of heavy metal contamination of Canadian freshwater fish. J. Fish. Res. Bd. Can. 28: 786-788.

The concentration of 13 toxic elements in dressed fish from a nonindustrialized and heavily industrialized freshwater area have been measured. With the exception of mercury, in no instance did levels exceed limits set by regulatory agents for lead, arsenic, copper, and zinc. Indeed in the majority of instances the levels from the industrialized area did not differ significantly from those of the nonindustrialized area.

Van der Schalie, Henry - See: Mary D. Rogick, No. 676.

810. Van der Schalie, Henry. 1938. The naiad fauna of the Huron River in southeastern Michigan. Univ. Mich. Mus. Zool. Ann Arbor, Mich. Miscellaneous Pub. 40. 83 p.

The study found the naiad fauna of the Huron River consists of 25 species, three doubtful ones were not counted. The species Lasmigona complanata and Carunculina parva are reported in the system for the first time. Fourteen types of habitats are listed, each with a distinctive fauna. Man and the muskrat are the most destructive forces for the naiads of this drainage. (SM)

Van Meter, Harry D. - See: Vernon C. Applegate, No. 25.

811. Van Meter, Harry D. 1973. Unharvested fishes in the U. S. commercial fishery of Western Lake Erie in 1969. U. S. Dept. Commerce. Ann Arbor, Mich. NOAA Tech. Rept. NMFS SSRF-670. 11 p.

Potential commercial fish production was estimated for U.S. waters of Western Lake Erie in 1969 from pounds landed and pounds discarded. Periodic observations of catches in haul seines and trap nets revealed that about 37% of the catch (by weight) in haul seines and 26% of that in trap nets were low-value fishes that were discarded. Projection of these discarded catches to include the total fishing effort indicated that an additional 2.8 million lb of low-value species would have been landed in 1969 if a reasonable profit had been assurred. It is concluded that the sustained yield could be increased considerably with only a moderate increase in fishing effort.

812. Van Meter, Harry D. and William F. Shepherd. 1967. Fishery picture changing in Lake Erie. N.Y. State Dept. Env. Cons. Albany, N.Y. Conservationist. 22(2):2-3.

A brief outline of the activities of the research vessel Musky II in New York waters of Lake Erie in September, 1965 and June, 1966. The objectives of these cruises were: to determine changes in the fish population and environmental conditions in recent years; to determine if the geographic and depth distributions of certain species of fish in the summer differ from that in the autumn; and to obtain much-needed information on the selectivity of experimental gill nets, particularly for the fresh-water drum (sheepshead) and the walleye.

813. Van Meter, Harry D. and Milton B. Trautman. 1970. An annotated list of the fishes of Lake Erie and its tributary waters exclusive of the Detroit River. Ohio J. Sci. 70(2):65-78.

Dramatic fluctuations have occurred in the abundance of many species in Lake Erie and its tributary waters in the last century. Some fishes of former economic importance have become commercially extinct. Several species apparently have been extirpated, especially in the tributaries. It is believed that further changes in the abundance of other species will occur in the near future. This publication

consolidates the confirmed records of fish species for Lake Erie and its tributaries. One hundred and thirty-eight species of fishes are listed and, where appropriate, brief comments on present and past distribution, and abundance and economic status are given. Selected references are listed as additional sources of information for each species.

814. Van Oosten, John. 1929. Some fisheries problems on the Great Lakes. Trans. Am. Fish. Soc. 59: 63-85.

A preliminary report on an evaluation of the various factors held responsible for the decline in the fisheries of Lake Erie and the other Great Lakes. Extensive data on the destructiveness of the various types of fishing gear in several areas of the lake and during different seasons of the year, as well as biological data on the nine most important commercial fish species were collected. (CCIW)

815. Van Oosten, John. 1930. The disappearance of the Lake Erie cisco - a preliminary report. Trans. Am. Fish. Soc. 60:204-214.

Review of production statistics on the cisco fishery and explanation of the collapse of the fishery in 1925 as the result of overfishing with bull nets (deep gill nets) in 1923 and 1924 when abnormal weather (heavy storms) had concentrated the stocks within a small area of deep water in Eastern Lake Erie. (CCIW)

816. Van Oosten, John. 1932. Experiments on the mesh of trapnets and legislation of the commercial fisheries of Lake Erie. Trans. Am. Fish. Soc. 62:100-107.

Description of experimental design and presentation of selected data to show type of results from studies of relation of mesh size to release of undersized fish and catch of legal-sized fish of several species. Recommendations are given on legal specifications for trap net meshes. (CCIW)

817. Van Oosten, John. 1935. First record of the alewife, Pomolobus pseudoharengus, for the state of Michigan. Copeia. 1935(4):194-195.

A report on the historical background of the appearance of the alewife in the waters of Michigan. Alewife findings in Lake Erie are discussed and it is postulated that their entrance to this lake was via the Welland Canal. (BU)

818. Van Oosten, John. 1935. Logically justified deductions concerning the Great Lakes fisheries exploded by scientific research. Trans. Am. Fish. Soc. 65: 71-75.

Presentation of data to prove that logically based assumptions and popularly held beliefs are incorrect with respect to the relation between mesh size and the size and number of fish taken, the relation between fishing time and the catch of stationary gear, and the role of pollution in the decline of fish stocks in the Great Lakes. (CCIW)

819. Van Oosten, John. 1937. First records of the smelt, *Osmerus mordax*, in Lake Erie. Copeia. 1937(1): 64-65.

A report on the historical background of the smelt in Lake Erie. The author concludes that at the time of this publication this species was firmly established in the lake and undoubtedly migrated from Lakes Huron and St. Clair. (BU)

820. Van Oosten, John. 1937. The dispersal of smelt, *Osmerus mordax* (Mitchill), in the Great Lakes region. Trans. Am. Fish. Soc. 66:160-171.

Record of plantings of smelt in the Great Lakes and a year-by-year account of the spread of the smelt through Lakes Michigan, Huron, Superior, and Erie. Its first appearance in Lake Erie was at Port Dover, Ontario in 1935. (CCIW)

821. Van Oosten, John. 1938. From cisco to perch to pike. State Govt. 11(3):55-57.

The depletion of certain fish populations due to overfishing in Lake Erie and the other Great Lakes is discussed. Production figures of Great Lakes fisheries are cited as supportive evidence. (BU)

822. Van Oosten, John. 1941. Relationship between the plantings of fry and production of whitefish in Lake Erie. Trans. Am. Fish. Soc. 71:118-121.

Study of correlation between whitefish fry plantings in Lake Erie and the later commercial production of whitefish. No evidence was found of benefits from plantings. (CCIW)

823. Van Oosten, John. 1948. Turbidity as a factor in the decline of Great Lakes fishes with special reference to Lake Erie. Trans. Am. Fish. Soc. 75:281-322.

Exhaustive treatment of the controversial question as to whether increase of turbidity due to improper land use or improper fishing has caused the decline of the Lake Erie fisheries. Review of literature on effects of turbidity on fish is followed by presentation of argument in support of conclusions: beach erosion and wind action rather than cropland erosion are principal sources of turbidity in Lake Erie; levels of turbidity are generally too low to affect fish adversely; trends in turbidity since 1910-15 have been downward not upward as many have believed; fluctuations of turbidity have shown no correlation with fluctuations of growth and strength of year classes; and restoration of the fisheries must come through scientific fishery management - not scientific farming. (CCIW)

824. Van Oosten, John. 1949. The present status of the United States commercial fisheries of the Great Lakes. Trans. 14th North Am. Wildlife Conf. pp. 319-330.

Discussion of depletion as exemplified by declining production in the face of more intensive and efficient fishing. Demonstrates from comparison of 1879-1903 and 1936-45 statistics that total U.S. yield would have decreased much more but for a large rise in the take of coarse fish. Includes data on the decline in production of important species in individual lakes. (SM)

825. Van Oosten, John. 1961. Records, ages and growth of the mooneye, Hiodon tergisus, of the Great Lakes. Trans. Am. Fish. Soc. 90(2):170-174.

The mooneye is scarce in Lakes Huron and Michigan but common in Lakes Erie and Ontario. Commercialization is limited to Ohio and Michigan waters of Lake Erie; reports of commercial catches elsewhere are errors resulting from misuse of common names. In Lake Erie the total lengths (inches) of certain age groups ran: I, 8.4; IV, 12.2; VII, 13.1. Largest fish was 14.5 inches and weighed 14.8 ounces. All are mature at 8.8 inches and 3.2 ounces. (BU)

826. Van Oosten, John and Ralph Hile. 1949. Age and growth of the lake whitefish, Coregonus clupeaformis (Mitchill), in Lake Erie. Trans. Am. Fish. Soc. 77:178-249.

Analysis of production statistics, 1871-1946, to bring out long-term trends of yield and shifts in centers of production and a general life-history study including consideration of fluctuations in growth and the strength of year classes in relation to environmental condition, length-weight relation (general relation, seasonal changes of condition, loss of weight at spawning), variation of sex ratio with age and by season, age at maturity, and spawning season. (BU)

827. Veal, D. M. and D. S. Osmond. 1968. Bottom fauna of the Western Basin and near-shore Canadian waters of Lake Erie. Internat. Assoc. Great Lakes Res. Proc. 11th Conf. on Great Lakes Res. pp. 151-160.

Bottom fauna in Western Lake Erie and in the near-shore Canadian waters of the Central and Eastern Basins were investigated by the Ontario Water Resources Commission in 1967. A total of 109 stations were sampled once or twice between April and August. Benthic communities varied considerably throughout the area. The Eastern Basin supported a wide variety of taxa, the most abundant species being Pontoporeia affinis. In the Central Basin, macro-invertebrate communities were characterized by a predominance of Pontoporeia affinis near Long Point and the tubificid Peloscolex ferox between Pte. aux Pins (Rondeau) and Point Pelee. Western Lake Erie supported relatively high tubificid populations, including Limnodrilus hoffmeisteri and L. cervix as the most abundant species. In general, there appears to be a gradation from communities indicative of moderately oligotrophic to mesotrophic conditions in the Eastern and Central Basins, to communities indicative of eutrophic conditions in Western Lake Erie.

Verduin, Jacob - See: Gladys L. McMillan, No. 516.

828. Verduin, Jacob. 1951. A comparison of phytoplankton data obtained by a mobile sampling method with those obtained from a single station. Am. J. Bot. 38(1):5-11.

A mobile phytoplankton sampling method, in which surface samples were dipped from the lake at 1/2-hr intervals over circuits which could be covered in a day's cruising at 10 mi

per hr, showed four- to twenty-fold variations in the samples from such a circuit. A day's circuit routinely showed evidence of at least three different communities existing side by side in an area comprising less than one-third of the western end of Lake Erie. Comparison of data obtained by mobile sampling, with data from a single station, showed that the major factor causing fluctuations in the station curve was water movement which insured the presence of a different community at the station on each successive sampling date. It is concluded that station sampling yields no reliable information on either (1) the time course of a phytoplankton pulse, or (2) the amount of plant matter produced. (BU)

829. Verduin, Jacob. 1951. Comparison of spring diatom crops of Western Lake Erie in 1949 and 1950. Ecology. 32(4):662-668.

During the spring months of 1949 and 1950, the diatom crops in Western Lake Erie were studied in order to determine and compare the approximate quantities of diatoms represented, as well as the rates of population growth and decay. The influence of diatom crops and turbidity on the food supply in Western Lake Erie is also discussed. (BU)

830. Verduin, Jacob. 1952. Photosynthesis and growth rates of two diatom communities in Western Lake Erie. Ecology. 33(2):163-168.

In the spring of 1950 an Asterionella-Cyclotella community was observed in the waters around Pelee Island and simultaneously a Stephanodiscus community was found 20 miles east of Pelee Island. Comparisons between these two communities are made and their photosynthetic rates, growth rates, and related characteristics are described and discussed. (BU)

831. Verduin, Jacob. 1952. The volume-based photosynthetic rate of aquatic plants. Am. J. Bot. 39(3):157-159.

The volume-based yields under optimal light intensities for naturally-occurring aquatic plants of Western Lake Erie are tabulated and compared with yields from the literature. (BU)

832. Verduin, Jacob. 1954. Phytoplankton and turbidity in Western Lake Erie. Ecology. 35(4):550-561.

Phytoplankton and turbidity data obtained from extensive areas in Western Lake Erie are presented and discussed.

Determinations of light-quenching effectiveness of suspended particles in waters of the Bass Islands region are also presented. (BU)

833. Verduin, Jacob. 1956. Energy fixation and utilization by natural communities in Western Lake Erie. Ecology. 37(1):40-50.

From 1951 to 1955 the rate of energy fixation and utilization by natural aquatic communities in Western Lake Erie were studied under near-natural conditions at all seasons of the year. The photosynthesis and respiration rates exhibited by communities concentrated by screening water through No. 25 silk bolting cloth, and by communities studied at their natural population density, are presented. Measurements of respiration of bottom fauna are included. These are related to environmental variables and the energy flow is estimated for (1) the total community, (2) the fraction retained by bolting cloth, and (3) the bottom fauna. (BU)

834. Verduin, Jacob. 1957. Daytime variations in phytoplankton photosynthesis. Limnology and Oceanography. 2(4):333-336.

A study of CO_2 removal during July and August, 1954, under natural conditions in Western Lake Erie demonstrated a maximal rate during the hours of 0700-1000 (10 µmoles CO_2 absorbed per liter of water per hour), a reduced rate during the hours 1000-1600 (6 µmol/L/hr), a slightly negative rate during the daylight hours 1600-1900 (-1 µmole/L/hr), and night-time negative rates similar to the day-time positive rates (-6 µmole/L/hr).

835. Verduin, Jacob. 1959. Photosynthesis by aquatic communities in Northwestern Ohio. Ecology. 40(3):377-383.

A study of photosynthetic rates under natural conditions, using pH change as a measure of CO_2 change was undertaken. Results showed that the rates under natural conditions were distinctly higher than those obtained with a community enclosed in a bottle. The highest yields per L were associated with relatively sparse populations (10 µL/L) and the lowest with dense populations (100 µL/L). (BU)

836. Verduin, Jacob. 1960. Phytoplankton communities of Western Lake Erie and the CO_2 and O_2 changes associated with them. Limnology and Oceanography. 5(4):372-380.

Phytoplankton studies using samples concentrated by settling revealed population densities several times higher than those reported previously, based on centrifuge and bolting cloth concentrates. Clear and dark bottle experiments employing natural population densities revealed photosynthetic yields averaging 1.6 µmoles of CO_2 absorbed per microliter of plant volume per hour. This yield is three times higher than previously reported yields based on artificially concentrated populations. Comparison of daily photosynthetic yields per square meter of water as computed from bottle data with yields measured under completely natural conditions indicated an additional twofold discrepancy, with the natural condition yielding the higher value.

837. Verduin, Jacob. 1962. Energy flow through biotic systems of Western Lake Erie. Am. Assoc. Advancement Sci. Great Lakes Basin. Pub. 71. pp. 107-121.

Western Lake Erie has a high vertical turbulence which is created by the seiche-generated currents. A relatively high rate of photosynthesis, amounting to 500 millimoles of CO_2 fixed per square meter per day, is supported by a well-mixed water column in which the products of respiration from the dysphotic zone are transported to the euphotic zone, and products of photosynthesis are moved to the dysphotic zone at a high rate. Several quantities related to energy flow have been established for Western Lake Erie and are considered to have wide application to other aquatic habitats. Photosynthetic yields per microliter of phytoplankton have been revised upward, as a result of investigations under completely natural conditions, from 0.5 to 3 or more micromoles of CO_2 fixed per hour, by populations whose average densities are 3 to 6 microliters per liter of water. The diurnal photosynthetic CO_2 absorption in excess of community respiration is practically equal to the nocturnal respiration, but a slight net CO_2 absorption from air is estimated at less than 13 millimoles per square meter per day.

838. Verduin, Jacob. 1963. Radioactivity of suspensoids in aquatic environments of Northwest Ohio. Ohio J. Sci. 63(1):39-43.

Suspensoids in aquatic environments of Northwestern Ohio contained between 12 to 23 times more radioactivity per gram than was present in the dissolved solids of the environment. No positive correlation was observed between radioactivity of suspensoids and phytoplankton volume. The river phytoplankton

volumes represented less than 1 percent of the suspensoids. Sphagnum plants from a bog showed higher concentration of radioactivity, per gram of ash, than was present in the suspensoids. When the concentration factors were computed as ratio of radioactivity per gram of fresh plant weight to the radioactivity per ml of environmental water a concentration factor of 550 was obtained. It is pointed out that similar concentration factors are obtained for non-radioactive portions of plant ash.

839. Verduin, Jacob. 1964. Principles of primary productivity: photosynthesis under completely natural conditions. In: D. F. Jackson (Ed.), Algae and Man. Plenum Press. New York, N.Y. pp. 221-238.

A comparison of photosynthesis and respiration in two small Pennsylvania ponds revealed that the two processes were in approximate equilibrium. The photosynthetic rates in the ponds were found to be significantly lower than those observed in Western Lake Erie. However, these higher rates were always associated with phytoplankton densities an order of magnitude lower than those in the ponds.

840. Verduin, Jacob. 1969. Man's influence on Lake Erie. Ohio J. Sci. 69(2):65-70.

Conversion of northwestern Ohio's Great Black Swamp to farm land during the last half of the nineteenth century had a profound, but scantily documented influence on Lake Erie. Silts, once largely filtered out by the swampland vegetation, were, with the destruction of that vegetation, carried into Lake Erie, where their effect in reducing light penetration has significantly altered the lake's biota.

More recently a spectacular enhancement of plant nutrients, especially phosphorus, which has increased five-fold since 1948, has supported nuisance levels of plant growth. This plant growth creates severe oxygen depletion near the lake bottom and is therefore responsible for additional major and undesirable changes in species composition of plant and animal communities. The obvious solution to this problem is the removal of the plant nutrients from the waters before they enter Lake Erie. The "living filter" treatment, in which sewage-plant effluents are filtered through root zones of plant communities, seems most promising. (BU)

841. Verduin, Jacob. 1970. Significance of phosphorus in water supplies. In: Wallrich and Smith (Eds.), Agricultural and Water Quality. Chapter 5, Pt. 2. pp. 63-71.

A report on the biological effects of plant nutrient pollutants, particularly phosphorus, in Lake Erie and other fresh-water habitats.

842. Verduin, Jacob, E. Eloise Whitwer and Bruce C. Cowell. 1959. Maximal photosynthetic rates in nature. Science. 130(3370):268-269.

It seems likely that turbulence under natural conditions, both aquatic and terrestrial, is higher than it is in the bottles or leaf chambers used when photosynthesis is measured experimentally. Most of the maximal photosynthetic rates reported in the literature are probably lower than those which occur in nature.

Vollenweider, Richard A. - See: R. Gachter, et al, No. 274.
Walter A. Glooschenko, et al, No. 285.
Walter A. Glooschenko, et al, No. 286.

843. Vollenweider, Richard A. 1974. The production biology of the lower Laurentian Great Lakes - a preamble. J. Fish. Res. Bd. Can. 31(3):251-252.

An introduction to a series of articles which are a report on an initial study of the production biology of Lakes Erie and Ontario. Twenty-five stations were established in Lake Erie at which studies of the distribution of chlorophyll, phyto- and zooplankton, dry weight, and measurements on board ship of primary production were conducted. (SM)

Voss, Edward G. - See: Kenneth E. Guire, No. 326.

844. Wagner, Frederick E. 1929. Chemical investigations of the Erie-Niagara watershed. In: A Biological Survey of the Erie-Niagara System. N.Y. Cons. Dept. Albany, N.Y. Suppl. 18th Ann. Rept. (1928). pp. 107-133.

A survey of the effects of water pollution on Lake Erie fish. The influences of tributary streams, municipalities and industries are discussed.

Walker, Bryant - See: A. E. Ortmann, No. 611.

845. Walker, Bryant. 1913. The Unione fauna of the Great Lakes. Nautilus. 27(2):18-23; (3):29-34; (4):40-47; (5):56-59.

A comparison of Atlantic fauna, Unione, with that of Lake Erie and the Detroit River. Fifteen genera and 39 species were attributed to Lake Erie. The relationship of distribution of Unione fauna to glacial movement is discussed in some detail. The present existence of so large a representation of the Mississippian fauna in Lake Erie is ascribed to a post-glacial invasion from the Mississippi Valley through the Maumee outlet into the post-glacial Lake Maumee. The original pre-glacial fauna of the present St. Lawrence system was absolutely exterminated during the glacial period. The peculiar fauna now characteristic of Lake Erie is the result of modification from environmental causes of the post-glacial immigrants from the south and not the result of any survival in that region of any part of the pre-glacial fauna. (SM)

846. Walker, Bryant. 1917. The type of Pleurocera Rafinesque. Univ. Mich. Mus. Zool. Ann Arbor, Mich. Occasional Paper 38. 10 p.

A review of the problems arising from the classification of fresh water univalve mollusca by Rafinesque. The author believes that Pleurocera acuta was not from Lake Erie but from the Niagara River. (SM)

847. Walton, L. B. 1915. A review of the described species of the order Euglenoidina Bloch. class Flagellata (Protozoa) with particular reference to those found in the city water supplies and in other localities of Ohio. Ohio Biol. Surv. Bull. 1(4):341-459.

A survey of the Euglenoidina of Ohio including descriptions of each species listed.

848. Walton, R. J. 1969. U. S. lakes survey: Directory and project forecasts - the Great Lakes. U. S. Army Corps of Eng. Lake Surv. District. Detroit, Mich. 166 p.

This report contains summaries of research in progress concerning the Great Lakes. The purpose of each study and a description of the approach to be used is included for most studies.

849. Ward, Henry B. 1916. Notes on two free-living larval trematodes from North America. J. Parasitology. 3(1):10-20.

A description is given of the structure and activity of two new cercariae of peculiar type captured free in Lake Erie and Lake St. Clair. They are designated Cercaria anchoroides nov. sp. and C. gorgonocephala nov. sp. A comparison is made between these species and known European species. (BU)

850. Ward, Henry B. and Thomas B. Magath. 1916. Notes on some nematodes from fresh-water fishes. J. Parasitology. 3(2):57-64.

A preliminary report on an extensive study of nematode parasites from North American fresh-water fishes. Described in this article are a number of new and interesting forms, one of which, Cystidicola stigmatura, was isolated from certain fish species of Lake Erie. (BU)

851. Watson, J. R. 1900. Preliminary list of filamentous algae of Cuyahoga County. Ohio Acad. Sci. 8th Ann. Rept. 1900:15.

A list of algae found in Cuyahoga County, Ohio. No collection sites or notes are included. (SM)

Watson, N. H. F. - See: G. F. Carpenter, et al, No. 144.

852. Watson, N. H. F. and G. F. Carpenter. 1974. Seasonal abundance of crustacean zooplankton and net plankton biomass of Lakes Huron, Erie and Ontario. J. Fish. Res. Bd. Can. 31(3):309-317.

Crustacean zooplankton concentrations (number/m^3) in the upper 50 meters of Lakes Ontario and Erie in 1970 and of Lake Huron in 1971 during all or most of the seasons, showed that the species of crustacean zooplankton present in the three lakes were generally identical, although the time of maxima and relative species composition differed. Biomass values were highest in Lake Erie, especially in the Western Basin. (SM)

853. Webster, Dwight A. 1967. Fishery management. N.Y. State Env. Cons. Dept. Albany, N.Y. Conservationist. 21(4):28-32.

An article concerning fish habitats with discussion of the following factors: deforestation, pollution, dams, roads, marsh drainage, and fish stocking. Lake Erie is mentioned as a large lake in which the fish habitat has been seriously affected. (SM)

854. Webster, Edward J. 1967. An autoradiographic study of invertebrate uptake of DDT-Cl^{36}. Ohio J. Sci. 67(5):300-307.

This research sought to locate autoradiographically DDT-Cl^{36} in tissues of leeches, amphipods, and copepods three months after their Sandusky Bay marsh habitat was treated with the amount of insecticide routinely used for mosquito control. Isotope DDT or its metabolite was found in cytoplasm of nerve cell bodies, gut mucosa, and vascular tissue of leeches. No isotope DDT was detected in the tissue of amphipods and copepods.

Weeks, Owen B. - See: David C. Chandler, No. 154.

855. Weeks, Owen B. 1944. A survey of the heterotrophic bacterial population in the sediments of Western Lake Erie. Ohio State Univ. Columbus, Ohio. Ph.D. Diss. 63 p.

Bottom samples from the Bass Islands region of Western Lake Erie were examined for their aerobic and anaerobic bacterial population and some of the environmental factors which were thought to influence these populations.

856. Wells, Larue and Robert House. 1974. Life history of the spottail shiner (Notropis hudsonius) in Southeastern Lake Michigan, the Kalamazoo River, and Western Lake Erie. Bur. Sport Fish. and Wildlife. Washington, D.C. Res. Rept. 78. 10 p.

Spottail shiner specimens were collected from Western Lake Erie, Lake Michigan, and the Kalamazoo River from 1958 to 1973. Depth and temperature distributions, age composition, sex ratio, annual and seasonal growth, length-weight relation, and reproduction are discussed. Comparisons between areas are made.

857. Wentz, W. Alan and Ronald L. Stuckey. 1971. The changing distribution of the genus Najas (Najadaceae) in Ohio. Ohio J. Sci. 71(5):292-302.

Over the past 70 years, the distributions of the species in the genus Najas in Ohio have undergone changes. Najas gracillima and N. flexilis, native species of northern, cool, clear waters, have disappeared or become reduced in abundance, while N. marina and N. minor, European species, and N. guadalupensis, a southern native species, have invaded, spread,

and/or have become more common in the state. Factors apparently responsible for these changes are (1) an increase in the numbers of artificial ponds and lakes, (2) an increase in the turbidity of Ohio waters, and (3) a gradual warming and overall general eutrophication of Ohio river and lake waters. Dated dot-distribution maps show the Ohio distributions of these species. Notes on the distribution of the species in nearby states are given. (BU)

858. Werner, W. H. R. Undated. Commercial fishing in Ontario. Ont. Dept. Lands and Forests. Commercial Fish. Sec. Toronto, Ont. 3 p.

A review of the significant changes which have occurred in the Ontario commercial fishery. The decline of the fishery of Lake Erie is discussed as are the changes in fishery methods in the lake. (CCIW)

White, Merrie N. - See: Irene S. Pakkala, et al, No. 619, 620.

859. Whitehead, W. 1967. Canada 1967. 4. The fish and the fur. Can. Audubon. 29(5):144-148.

A popular article tracing the development of the fishing and trapping industries of Canada. The decline of the sturgeon and other species in Lake Erie is mentioned. Comment is made on the relationships of lake trout, pollution problems, and the recovery of the Great Lakes. Studies in the United States indicating that Lake Erie could rid itself of destructive wastes in six years, while the deeper lakes would require a much longer period are discussed. (SM)

Whitman, I. L. - See: F. A. Butrico, et al, No. 117.

Whitwer, E. Eloise - See: Jacob Verduin, et al, No. 842.

Wickliff, Edward L. - See: Raymond C. Osburn, et al, No. 617.

860. Wickliff, Edward L. 1920. Food of young small-mouth black bass in Lake Erie. Trans. Am. Fish. Soc. 50:364-371.

The feeding habits of young small-mouth bass from the island region of Lake Erie were determined thru stomach analysis of 313 bass collected in 1919 and 1920. Data reveals that copepods and cladocerans are the first food of the young bass; they were found in from 80-90% of the collected specimens. (CCIW)

861. Wickliff, E. L. 1931. Fishery research by the Ohio Division of Conservation. Trans. Am. Fish. Soc. 61:199-207.

A summary of the major research projects in progress at the time of this article, at the Bureau of Scientific Research, State Division of Conservation, of the Department of Agriculture. (CCIW)

862. Wickliff, E. L. 1933. The practical value of determining the fertility of whitefish eggs. Trans. Am. Fish. Soc. 63:144-150.

The practical value of determining the fertility of whitefish eggs is discussed. Fertility tests were made at Put-in-Bay; the technique is described. By determining the fertility the hatchery employee can, if the fertility is not up to normal, advise the spawn taker how to improve the quality of the eggs. (CCIW)

863. Wickliff, E. L. 1933. Returns from fish tagged in Ohio. Trans. Am. Fish. Soc. 63:326-331.

A summary of the returns from fish tagged and released in Ohio streams during the period between 1930 to 1932. (CCIW)

864. Wiebe, A. H. 1926. The first three larval stages of _Hexagenia bilineata_ Say. Ohio J. Sci. 26(5): 267-275.

Presents a post-embryonic study of the first three larval stages of _Hexagenia bilineata_. (BU)

865. Wiebe, A. H. 1926. Variations in the freshwater snail, _Goniobasis livescens_. Ohio J. Sci. 26(2):49-68.

This study was undertaken to see if a correlation exists between the shape and size of the shells of the snail, _Goniobasis livescens_, and the degree of exposure to wave action. Collection sites included stations in the vicinity of Put-in-Bay and a station in the Olentangy and Sciota Rivers for comparative purposes. Tables are presented which show that the average obesity is directly proportional to the degree of wave action. (BU)

Wilkens, Richard A. - See: Robert D. MacNish, et al, No. 498.

866. Williams, Louis G. 1966. Dominant planktonic rotifers of major waterways of the United States. Limnology and Oceanography. 2(1):83-91.

Rotifers were the most numerous metazoans found in preserved plankton samples taken from the City of Buffalo water intake on Lake Erie. This site was one of 128 sampling stations on the major rivers and Great Lakes of the U. S. Semi-monthly plankton samples (counts/liter) were taken for all months in 1961 and 1962. These 48 samples revealed 9 different genera of rotifers with five or more individuals. The five most abundant of these were Brachionus, Keratella, Polyarthra, Synchaeta and Trichocera. The average number of rotifers per 1 liter sample for all 48 samples was 106.3.

867. Williams, Stephen R. 1921. Concerning "larval" colonies of Pectinatella. Ohio J. Sci. 21(4):123-127.

A discussion of the sexual reproduction of the Bryozoan, Pectinatella. (BU)

868. Wilson, Charles B. 1929. The macroplankton of Lake Erie. In: Charles J. Fish (Ed.), Preliminary Report on the Cooperative Survey of Lake Erie, Season of 1928. Bull. Buffalo Soc. Nat. Sci. Buffalo, N.Y. 14(3):94-135.

This survey presents an excellent idea of the composition of the macroplankton of Eastern Lake Erie as well as of its horizontal distribution. Plankton species are of adequate size, present in sufficient numbers and contain a percentage of nutritive material high enough to make them capable of furnishing ample food to an exceptionally large number of small fish. Therefore the decrease in the lake fisheries can not be attributed to any kind of an inadequacy in their food supply.

869. Wilson, Charles B. 1929. The macroplankton of Lake Erie. In: Charles J. Fish (Ed.), A Preliminary Report on the Joint Survey of Lake Erie. A Biological Survey of the Erie-Niagara System. N.Y. Cons. Dept. Albany, N.Y. Suppl. 18th Ann. Rept. (1928). pp. 67-76.

Survey presenting the type and amount of macroplankton in Eastern Lake Erie; also their horizontal distribution with suggestions as to vertical and seasonal distribution.

870. Wilson, Charles B. 1960. The macroplankton of Lake Erie. In: Charles J. Fish (Ed.), Limnological Survey of Eastern and Central Lake Erie, 1928-1929. U. S. Fish and Wildlife Service. Washington, D. C. Spec. Sci. Rept. Fish. 334. pp. 145-172.

The results of a survey conducted in Lake Erie, exclusive of that area west of the island region. Discussed are: components and amounts of plankton, species present, horizontal and seasonal distribution, littoral and lacustric zone macroplankton, and macroplankton as intermediate hosts.

871. Wolfert, David R. 1963. The movements of walleyes tagged as yearlings in Lake Erie. Trans. Am. Fish. Soc. 92(4):414-420.

A total of 3,998 yearling walleyes, Stizostedion vitreum vitreum (Mitchill), were captured, tagged, and released along the south shore of Western Lake Erie to determine their movements and their dispersal from a known nursery area. Four hundred ninety-nine recoveries were made over a period of 3 years. Tagged walleyes traveled primarily north toward the islands in the Western Basin during their first year of liberation, and in succeeding years moved progressively toward the extreme western end of the lake. Some walleyes were recaptured within 6 months in the Detroit River, Lake St. Clair, the St. Clair River, and southern Lake Huron, and the percentage of fish recaptured in these waters north of Lake Erie increased annually. Movement eastward into the Central and Eastern Basins of the lake appeared negligible. The greatest distance traveled by a marked walleye was 236 miles. The average distance traveled by all tagged fish was 25 miles.

872. Wolfert, David R. 1969. Maturity and fecundity of walleyes from the Eastern and Western Basins of Lake Erie. J. Fish. Res. Bd. Can. 26(7): 1877-1888.

A report on a survey in which 2427 walleyes from the Eastern and Western Basins of Lake Erie were examined to determine the age at which maturity is reached. Comparisons between sex and basin are made. Also studied were the relationships between egg production, fecundity, weight and age in both basins. Weight was the most accurate indication of fecundity while little relation existed between egg diameter and length or age of fish.

873. Wolfert, David R., Vernon C. Applegate and Leonard N. Allison. 1967. Infection of the walleye, Stizostedion v. vitreum of Western Lake Erie with Bothriocephalus cuspidatus (Cooper). Papers Mich. Acad. Sci., Arts, and Letters. 52(1):105-114.

This paper describes the caecal and intestinal parasites of the walleye, Stizostedion vitreum vitreum. The study concerns the type and degree of intestinal parasitic infestations in a single year class of walleyes during their first 3 years of life, seasonal changes in the incidence and maturity of the dominant parasite, Bothriocephalus cuspidatus, and the effects of the infestations on the physical condition of the host.

874. Wolfert, David R. and Jarl K. Hiltunen. 1968. Distribution and abundance of the Japanese snail, Viviparus japonicus, and associated macrobenthos in Sandusky Bay, Ohio. Ohio J. Sci. 68(1): 32-40.

A survey of the macrobenthos of Sandusky Bay, Lake Erie, in June 1963, provided information on the abundance and distribution of the introduced Japanese snail, Viviparus japonicus, which has become a nuisance to commercial seine fishermen. Environmental characteristics were nearly uniform and had no apparent effect on the distribution; concentrations in different areas at different times appeared to result from water movements induced by winds. The frequency distributions of shell height and diameter suggested the presence of two age groups of adults in the population. Only three other gastropods were observed in the bay; the most abundant was another viviparid, Campeloma decisum. Other mollusks present were four species of Sphaeriidae and 18 species of Unionidae. A summary of invertebrates found, other than the mollusks, is also presented.

875. Wood, Kenneth G. 1963. The bottom fauna of Western Lake Erie, 1951-1952. Univ. Mich. Great Lakes Res. Div. Proc. 6th Conf. on Great Lakes Res. Pub. 10:258-265.

Western Lake Erie was found to contain a diverse and abundant bottom fauna. Sixty-two different organisms were found in 204 samples. The most abundant groups were: Unionidae, aquatic insects, sphaeriids, snails and leeches. The most

abundant organisms were *Lampsilis siliquoidea*, and the now scarce *Hexagenia* spp. The most productive area in the lake seemed to be a sand habitat near Maumee Bay. Mollusca in general were more abundant in the western half of the Western Basin. The particle-size distribution of the substrate seemed less important than other environmental factors in determining the distribution of most species. (RL)

876. Wood, Kenneth G. 1968. Pollution and Lake Erie. Bioscience. 39(3):103-110.

The major types of pollution in Lake Erie are discussed with an emphasis on phosphorus as a chemical nutrient. The responses of the fauna and flora of the lake to this nutrient are examined.

877. Wood, N. A. 1910. Bird migration at Point Pelee, Ontario in the fall of 1909. Wilson Bull. 22(2):63-78.

A journal account of bird observations made from September 14, 1909 through October 16, 1909. A wide variety of birds were seen. (SM)

878. Wright, Jim. 1966. The Coming Water Famine. Cowan-McCann, Inc. New York, N.Y. 255 p.

This book reviews the uses of water in modern society and emphasizes the importance of it as a resource. Receding water levels in the Great Lakes are the subject of much concern with regard to water supply and shoreline changes. The importance of water conservation and pollution control are stressed. (BECPL)

879. Wright, Stillman and Wilbur M. Tidd. 1933. Summary of limnological investigations in Western Lake Erie in 1929 and 1930. Trans. Am. Fish. Soc. 63:271-285.

A report on the 1929-30 study of the pollution situation in Western Lake Erie as indicated by chemical analyses, phytoplankton, zooplankton, and bottom fauna. It was held that the harm from the heavy pollution of certain limited areas was in some measure counterbalanced by fertilizing effects of pollutants and that pollution probably was not the controlling factor in the production of fish in Western Lake Erie. (CCIW)

York, H. H. - See: W. A. Kellerman, No. 421.

Youatt, W. G. Jr. - See: R. J. Aulerich, et al, No. 29.

Youngs, William D. - See: Raymond J. Lovett, et al, No. 489.

Zack, Nancy - See: Robert G. Rolan, et al, No. 678.

Zaebst, K. - See: R. M. Pfister, et al, No. 636.

880. Zagorski, Stanley J. and Celia B. Galus. 1972. A bacteriological analysis of Presque Isle Bay at Erie, Pennsylvania, 1971. Internat. Assoc. Great Lakes Res. Proc. 15th Conf. on Great Lakes Res. pp. 214-220.

A study was undertaken to determine types of potentially pathogenic organisms commonly introduced into Presque Isle Bay at Erie, Pennsylvania. Standard bacteriological techniques were employed to isolate the following organimsms: total and fecal coliform, enterococci, Salmonellae and other Enterobacteriacea. Total and fecal coliform and enterococci densities were compared with the frequency of Salmonellae isolated.

881. Zenkert, Charles A. 1934. The flora of the Niagara Frontier region. Bull. Buffalo Soc. Nat. Sci. Buffalo, N.Y. 16:1-328.

A monograph tracing the history of botanical explorations in the Niagara Frontier region from 1750 to 1934. The area studied is within a fifty mile radius of Buffalo, N.Y. Climatic conditions influencing the flora of the region and aquatic vegetation along the Lake Erie shore are described. Included is a systematic account of the species found. (SM)

882. Zillig, Andrew M. 1929. Bacterial studies of Lake Erie. In: Charles J. Fish (Ed.), A Preliminary Report on the Joint Survey of Lake Erie. A Biological Survey of the Erie-Niagara System. N. Y. Cons. Dept. Albany, N.Y. Suppl. 18th Ann. Rept. (1928). pp. 56-58.

This report presents the sanitary condition of Eastern Lake Erie during July and August 1928, including methods and results obtained with interpretations.

883. Zillig, Andrew M. 1929. Bacteriological studies of Lake Erie. In: Charles J. Fish (Ed.), Preliminary Report on the Cooperative Survey of Lake Erie, Season of 1928. Bull. Buffalo Soc. Nat. Sci. Buffalo, N.Y. 14(3):51-59.

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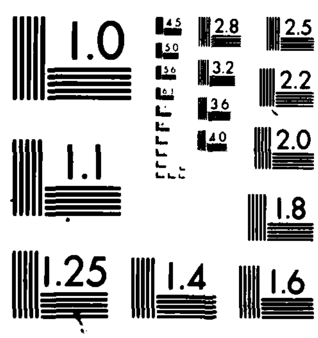

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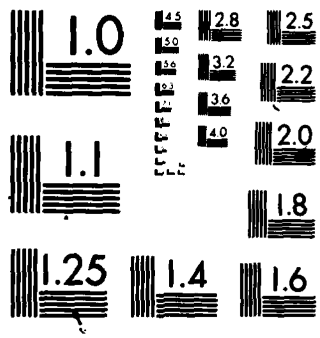

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VI. ACKNOWLEDGEMENTS

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VII. ABBREVIATIONS

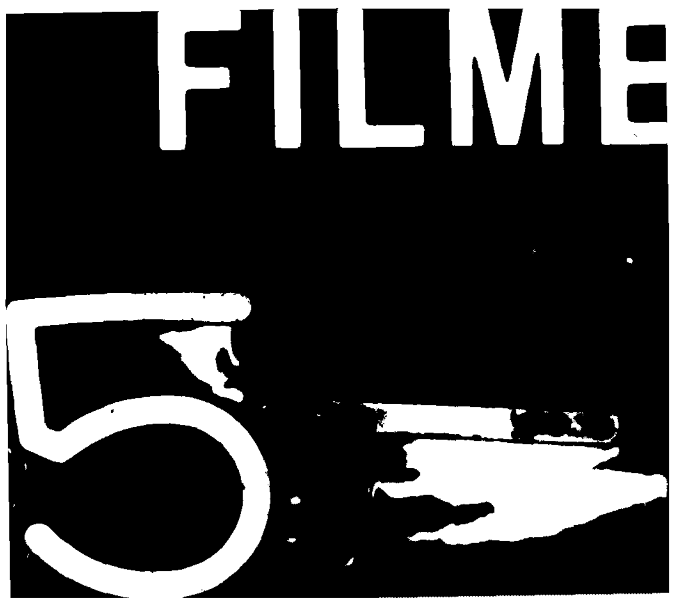
Acad.	Academy
Admin.	Administration
Adv.	Advancement
Agric.	Agriculture
Am.	American
Ann.	Annual
ASChE	American Society of Chemical Engineers
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
Assoc.	Association
Bd.	Board
BECPL	Buffalo and Erie County Public Library
Biol.	Biology, Biological
BL	Bell Library - State University N.Y. at Buffalo
Bot.	Botany, Botanist
BU	Butler Library - New York State University College at Buffalo
Bull.	Bulletin
Bur.	Bureau
CA	Calspan Corporation Library
Calif.	California
Can.	Canada, Canadian
CCIW	Canada Centre for Inland Waters Library
CE	Corp of Engineers - Buffalo District Library
Chem.	Chemistry, Chemical
Circ.	Circular
Co.	Company
Comm.	Commission
Conf.	Conference
Conn.	Connecticut
Cons.	Conservation
Contrib.	Contribution
Cult.	Cultural, Culturist
Dept.	Department
Dev.	Development

Diss.	Dissertation
Div.	Division
ECHO	Environmental Clearing House Organization
Ecol.	Ecology, Ecological
Ed.	Editor, Edition
Eng.	Engineering
Env.	Environment, Environmental
EPA	Environmental Protection Agency
Exp.	Experiment, Experimental
Fish	Fishery
FWPCA	Federal Water Pollution Control Administration
Gaz.	Gazette
Geog.	Geographic, Geographical, Geography
Geol.	Geologic, Geological, Geology
Geophys.	Geophysical
GLL	Great Lakes Laboratory
Gov't.	Government
Ill.	Illinois
Inc.	Incorporated
Info.	Information
Inst.	Institute
Internat.	International
Invest.	Investigation
J.	Journal
Lab.	Laboratory
LO	Lockwood Library - State University New York at Buffalo
MA	Master of Arts
Mag.	Magazine
Manage.	Management
Mar.	Marine
Mass.	Massachussetts
Memo.	Memorandum
Meteor.	Meteorological, Meteorology
Mich.	Michigan
Micro.	Microscopical
Mid.	Midland
Minn.	Minnesota
Mon.	Monthly
Monit.	Monitoring
Mono.	Monographs

M.Sc.	Master of Science
Mus.	Museum
Nat.	Natural, Naturalist
NOAA	National Oceanic and Atmospheric Administration
N.Y.	New York
Okla.	Oklahoma
Ont.	Ontario
p.	Page
pp.	Pages (inclusive)
_p.	Pages (total in report)
Pt.	Part
Penn.	Pennsylvania
Pestic.	Pesticides
Petrol.	Petrology
Phil.	Philosophical
Pop.	Popular
Proc.	*Proceedings*
Prog.	Progress, Progressive
Pub.	Publication, Publisher, Publishing
Rec.	Record
Rept.	Report
Res.	Research
Rev.	Review
RL	Ridge Lea Library - State University New York at Buffalo
Sci.	Science, Scientific
SE	Science and Engineering Library - State University New York at Buffalo
Sec.	Section
Sed.	Sedimentary
Ser.	Series
SL	Sears Library - Case Western Reserve University
SM	Buffalo Museum Science Research Library
Soc.	Society
Spec.	Special
Suppl.	Supplement
Surv.	Survey
Tech.	Technical
Trans.	Transactions

Univ. -------------------------- University
U.S. --------------------------- United States
Vol. --------------------------- Volume
Wash. -------------------------- Washington
Weat. -------------------------- Weather
Wisc. -------------------------- Wisconsin
Zool. -------------------------- Zoology

NOTE: Ohio Naturalist - See: Beginning volumes of
Ohio Journal of Science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